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APRIL 1967

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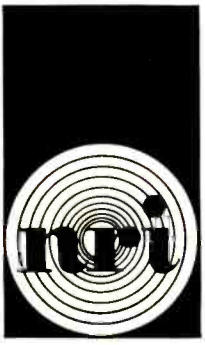
Build Signal Tracer Using FET Circuit

(see page 43)



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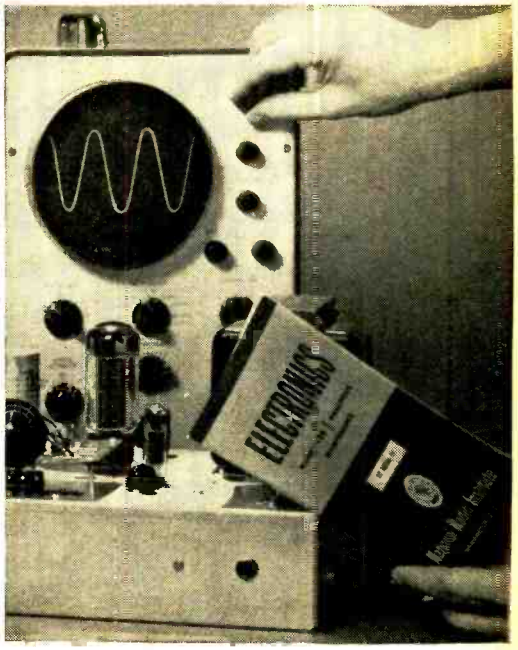

POPULAR ELECTRONICS

WORLD'S LARGEST-SELLING ELECTRONICS MAGAZINE

VOLUME 26 **APRIL, 1967** NUMBER 4

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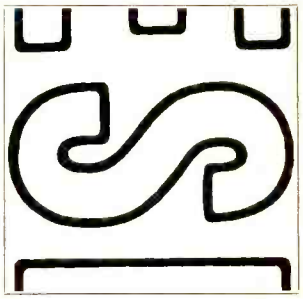

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CIRCLE NO. 28 ON READER SERVICE PAGE

LETTERS
FROM OUR READERS

Address correspondence for this department to: Letters Editor, POPULAR ELECTRONICS One Park Avenue, New York, N. Y. 10016

SOME CANADIAN NICKELS NOT "NICKEL"

Experimenters making "Tesla's Thermomagnetic Motor" (December, 1966) may experience some difficulty in finding Canadian "nickels," as not all of these coins are made of nickel. Some of the 1942 issue and all of the 1943 issue were made of tombac (88% copper, 12% zinc). In 1944 and 1945, the "nickels" were struck in chromium-plated steel, as well as a portion of the 1951 issue and all of the 1952, 1953, and 1954 issues. In 1955, nickel coinage was resumed, and has continued through 1966. If anyone has trouble with the motor, this may be the reason.

HARRIS RUBEN
Bayonne, N.J.

I will send a Canadian nickel to anyone who will send me ten cents in coin and a self-addressed envelope. These nickels are available in both circular and 12-sided shapes, and I will supply either one if a choice is specified.

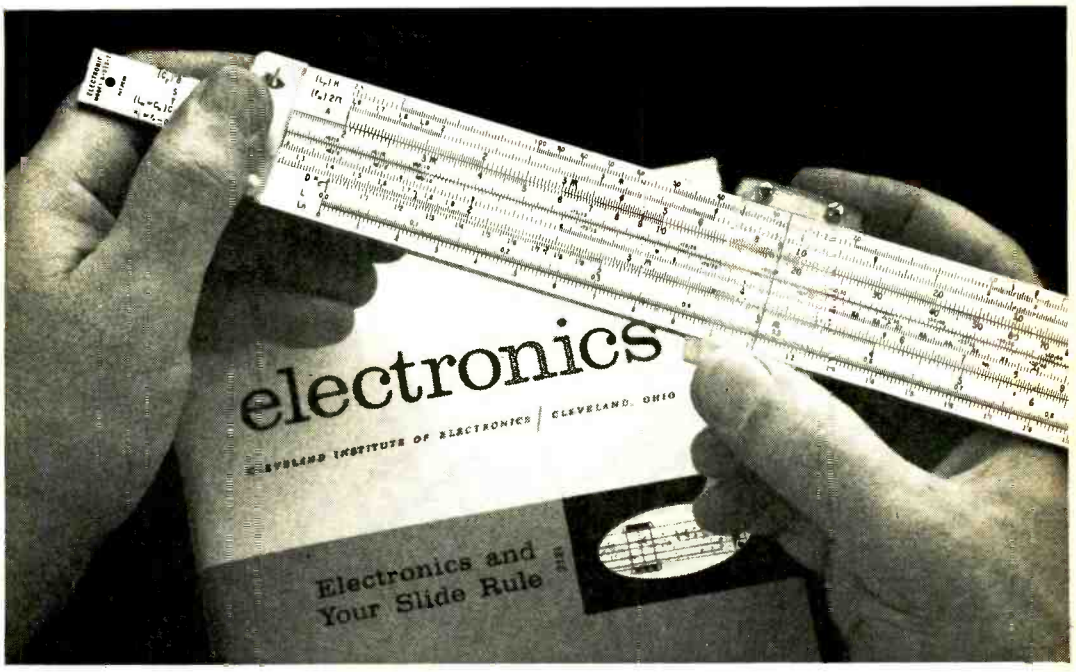
A2C HAROLD H. TESSMANN, JR.
Box 186, Minot AFB
North Dakota 58701

Thanks for the info, Harris. Canada is not alone. We took the silver out of our quarters and dimes, and some countries have paper pennies. Harold, be sure your Canadian nickels really are made of nickel.

HETERODYNE VEGETATION METER

Writer William B. Morse in reporting on the "Heterodyne Vegetation Meter" (January, 1967) implies that the device was invented by the Neals, Donald L., and Lee R., of the U.S. Forest Service. The design concept and results of testing a capacitance de-

A New Electronic Slide Rule with Instruction Course



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CIRCLE NO. 5 ON READER SERVICE PAGE

LETTERS

(*Continued from page 8*)

vice of this kind for measuring the volume of growth of range grasses were published several years ago by Mr. Joel E. Fletcher, at that time an employee of the U.S. Soil Conservation Service, and now a research professor on the staff of the Utah Water Resources Research Laboratory, Utah State University.

ROBERT B. HICKOK
Tucson, Ariz.

THE "BRUTE-70"

I would like to build your solid-state amplifier, the "Brute-70," (February, 1967) but consider it much too "high power" for me. What changes could be made to tone it down to 40 or 50 watts output? I have two "Sweet Sixteen" cabinets and speakers; also a 12" Altec Lansing speaker.

PATRICK J. MCCARTHY
Fruitland, Idaho

Is the "Four on the Floor" speaker system (November, 1966) capable of handling 70 watts? If not, could you recommend a speaker system for use with the "Brute-70"?

JOHN P. SERIO
Rochester, N.Y.

I have the original RCA article (circuit) on this amplifier, which was published in the latest RCA Transistor Manual (Series SC-12). Upon comparing the two, I found some discrepancies which I now call to your attention so that you may inform me if there were any printing errors. In the original schematic, *C4* (100 pF) is shown across *C3* and *R5;* a 180-μF (I am sure they meant a 180-pF) capacitor is shown from the base of the 40407 (*Q2*) to ground; and both *R15* and *R16* are shown as 0.3-ohm resistors instead of 0.33- and 0.27-ohm units.

JOSE BANOS
Engineer, WXOK
Baton Rouge, La.

Jose, we contacted RCA prior to publishing this article, and they agreed that the changes made in the "Brute-70" were desirable improvements. We suggest that you follow the circuit as published in POPULAR ELECTRONICS. *John and Pat, it stands to reason that if you overpower a set of speakers, they are apt to blow smoke rings. However, it isn't likely that you would drive any of the speakers mentioned hard enough to damage them. Just because a car is equipped with a 300-horsepower engine doesn't mean that you have to use full power to drive it, nor does it mean a car will be able to handle the full power safely, or for any length of time. But the smooth response to the touch of your toe and the reserve power make it desirable to have the big engine. Similarly, judicious use of level controls will let you enjoy the dynamic range of a high-power amplifier. You can control the power output from zero to its maximum rating. Do avoid wide-open op-*

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CIRCLE NO. 27 ON READER SERVICE PAGE

LETTERS (*Continued from page 10*)

eration; don't plug and unplug any inputs while the amplifier is on. One way to limit the power output is to lower the B+ voltage, but it isn't necessary for you to do so.

LOW-POWER STEREO AMPLIFIER

I have just read your "Brute-70" article (February, 1967), and am very much interested in this type of amplifier. Could you please tell me where I might obtain complete plans for a stereo solid-state power amplifier having only 25-40 watts per channel?

BRIAN SAMUELS
Kingston, Ontario, Canada

Brian, if you are worried about the high-power aspect of the "Brute-70," see our comments above. Among the best sources of a complete set of plans for a lower power amplifier are the kit manufacturers, and one or more of them might be persuaded to sell you a construction manual only. But if you decide to build an amplifier as described in any of these manuals, you would be wise to get the complete kit.

ODDS ON 7 ARE 6 TO 1

Regarding the "Electric Dice Game—No Dice" (October, 1966, *Letters*), I would like to correct Solomon Rosenstark on *his* correction of the odds for the dice game. He stated that the probability of getting a 7 on one throw of the dice was a sixteenth. It is a sixth.

L. R. BRITTEN
Oakland, Calif.

Don't blame Mr. Rosenstark, L.R.; this was a typographical error, and our proofreaders failed to catch it. Could be a case of a fifth on the rocks.

MOTORCYCLE BATTERIES

The "Tip" entitled "Use a Motorcycle Battery to Drive Your Projects" (January, 1967), is an excellent one. However, a much more versatile 6-volt battery which can be charged and/or discharged in any position without any leakage or acid fumes is available from Centralab distributors as Catalog No. RP-626. This battery is rated at 2.6 ampere hour at 6 volts (6.45 volts fully charged), and measures only 5.3" x 2.4" x 1.3".

N. E. NELSON
Sales Engr., Dist. Div.,
Centralab
Milwaukee, Ws.

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CIRCLE NO. 25 ON READER SERVICE PAGE

LETTERS (*Continued from page 12*)

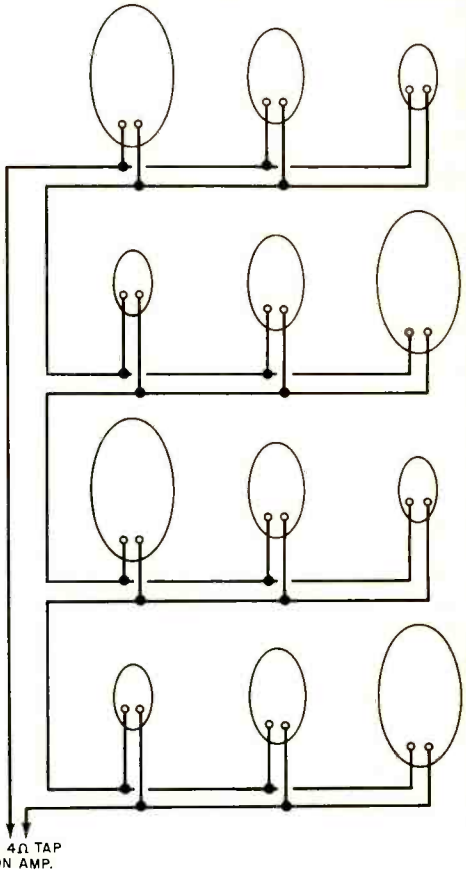
on top of my head, the picture clears up and becomes sharp. Why? Am I seeing things or is there an electromagnetic principle involved?

DR. P. STAPPENBECK
Fort Meyers, Fla.

Any type of antenna capable of affecting TV signals toys with electromagnetic principles, even if it's only a pair of hands. Rabbit ears, take note.

OUT OF TUNE

The "Mixed Twelve" Speaker System (*March*, 1967, *page* 96). Some copies of the magazine were distributed with an incorrect wiring diagram of the series-parallel speaker hookup. The error is obvious (all of the speakers



were shown wired in parallel), but check your copy to be sure. Clip out this correct diagram and paste it over the incorrect one if you have a bad copy. —30—

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PARTS METHODS IDEAS GADGETS DEVICES TIPS & TECHNIQUES

CLOCK CASE BAFFLES SMALL SPEAKER

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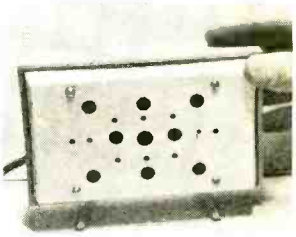

—Homer L. Davidson

PUT "ADD-A-CHANNEL" IN YOUR LIMITED-CHANNEL TRANSCEIVER

The versatility of single- and limited-channel transceivers can be increased if you install an extra transmit crystal socket on the front panel of your transceiver as shown circled in the photo. You can then plug in a different, suitable, transmit crystal to operate on another available channel. Drill the mounting and socket terminal holes in the front panel, and mount the socket. Then solder one end of a set of copper wires to the socket terminals and plug the other ends of the wires into the crystal socket inside the transceiver. Keep the wires as short as possible, and avoid loose connections.

—John F. Casazza

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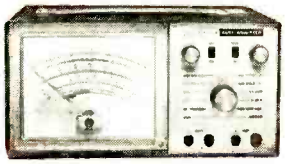

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CIRCLE NO. 8 ON READER SERVICE PAGE

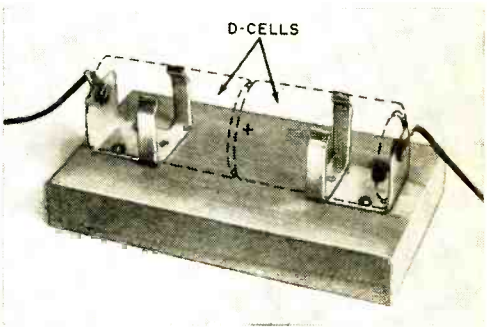
TIPS

(*Continued from page* 16)

filaments in the tube rectifier. Just be sure that you select suitably rated diodes and that they are connected properly. If polarity is not observed, you run the risk of destroying the filter capacitors as well as the diodes. The latter can be fitted directly into a tube base and soldered to the pins. Since silicon diodes have a smaller voltage drop than vacuum tube-type rectifiers, a higher voltage is delivered to the power supply's filter capacitors. In order to prevent damage to the capacitors, re-form them to the higher working voltage level simply by switching the a.c. power on and off a few times. —*J. F. Giunta*

TWO-FOR-THE-PRICE-OF-ONE BATTERY HOLDER

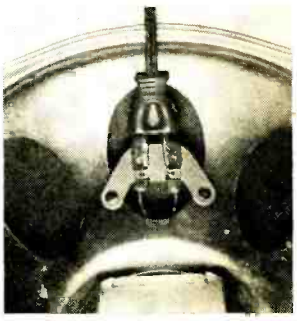
The next time you need two D-cell battery holders and find that you have only one on hand, cut the holder in half and mount the two halves on a piece of wood, or on your



chassis, spaced just far enough apart to accept both cells. Use a fine-tooth hacksaw blade to cut through the center clips of the holder.
—*Art Trauffer*

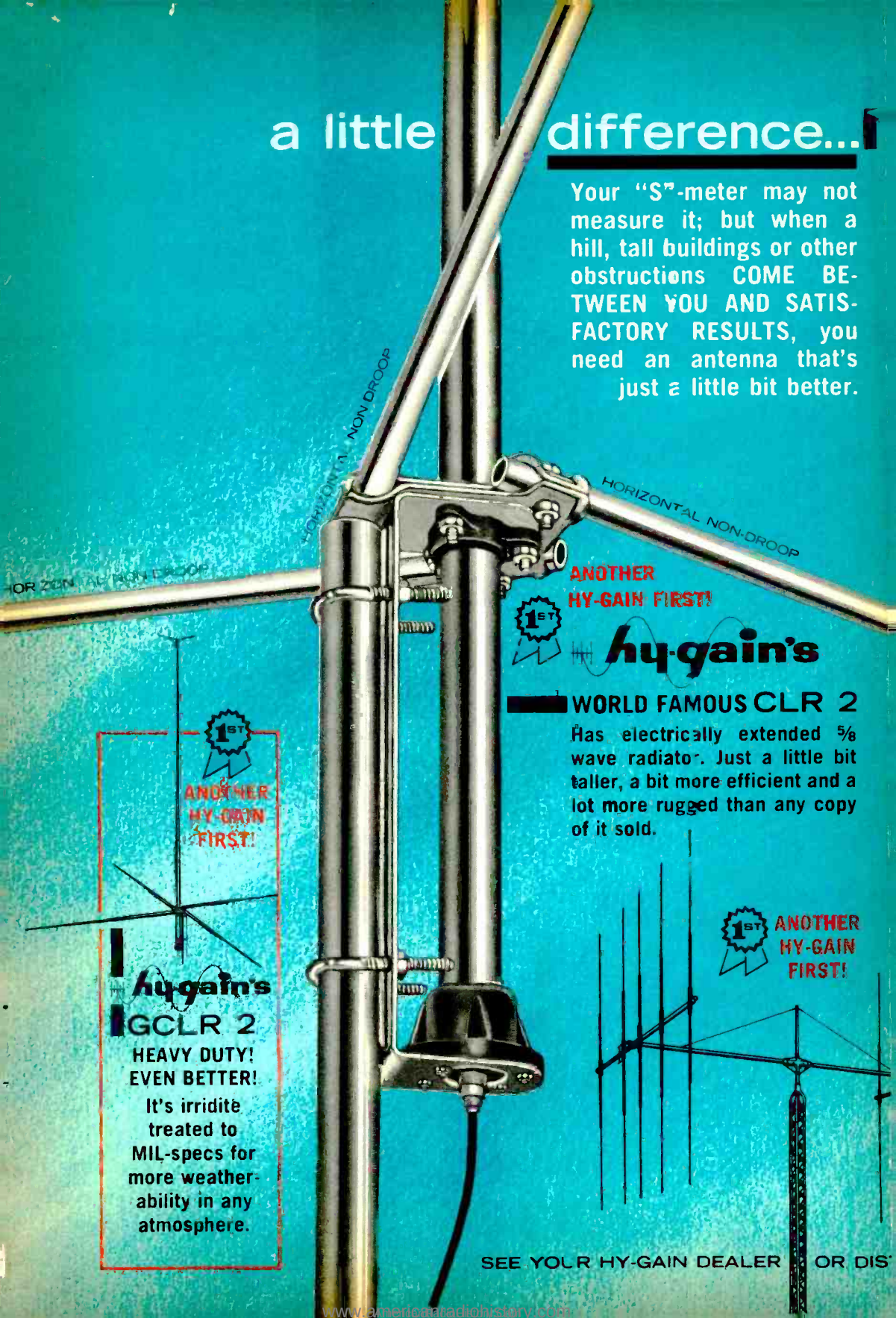
A.C. LINE CORD DOUBLES AS SPEAKER CABLE

Speakers equipped with quick-disconnect connectors can be hooked up to a modified a.c. line cord and plug. Twist the prongs on the plug so that they are at right angles to their normal position. Then carefully enlarge the speaker connector slots just enough to accept the prongs. Plug in the power cord as shown in the photo; adjust the connectors to obtain a snug fit and good electrical contact. —*Carl Dunant*



a little difference...

Your "S"-meter may not measure it; but when a hill, tall buildings or other obstructions COME BETWEEN YOU AND SATISFACTORY RESULTS, you need an antenna that's just a little bit better.



ANOTHER HY-GAIN FIRST!

hy-gain's

WORLD FAMOUS CLR 2

Has electrically extended 5/8 wave radiator. Just a little bit taller, a bit more efficient and a lot more rugged than any copy of it sold.

ANOTHER HY-GAIN FIRST!

hy-gain's

GCLR 2

HEAVY DUTY! EVEN BETTER!

It's irridite treated to MIL-specs for more weather-ability in any atmosphere.

ANOTHER HY-GAIN FIRST!

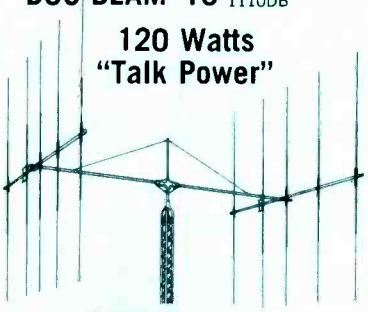
SEE YOUR HY-GAIN DEALER OR DIS

in hy-gain's COMPLETE LINE of CB ANTENNAS AND ACCESSORIES

hy-gain's ROTATABLE DUO-BEAMS

DUO-BEAM 10 MODEL 1110DB

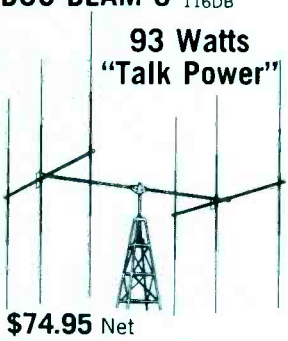
120 Watts "Talk Power"



$119.95 Net

DUO-BEAM 6 MODEL 116DB

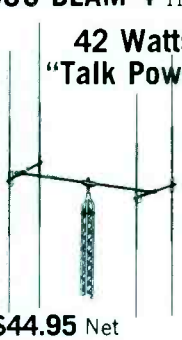
93 Watts "Talk Power"



$74.95 Net

DUO-BEAM 4 MODEL 114DB

42 Watts "Talk Power"



$44.95 Net

ALL HY-GAIN DUO-BEAMS HAVE THESE SPECIFICATIONS:
• SWR at Resonance – Less than 1.4:1 • Accept 52 ohm Coaxial Feedline
• Maximum Wind Survival – 80 MPH

SPECIFICATIONS		1110DB	116DB	114DB
ELECTRICAL:	Front-to-Back Ratio	26 db	23 db	18 db
MECHANICAL:	Boom Length	18 ft.	12'2"	3'1"
	Cross Boom Length	24 ft.	14'	9'
	Longest Element	18'9¾"	18'6½"	17'11"
	Turning Radius	15'6"	9'6"	5'2"

"F DISTINCTION" Hy-Q loading coil.

lifetime adjustable tuning rod.

TRUNK DECK JIFFY TOPPER

Guaranteed performance. Easy trunk lid installation. Mounts on trunk lip – no exterior holes to drill. 50" overall height. Complete with adjustable stainless steel mount, antenna, PL-259 connector and coaxial cable. **Model TJCQ**.....**$15.95** Net.

MARINE TOPPER

Guaranteed 1.5db Gain. Most efficient marine antenna available. Mounts on any wood or fiberglass boat. Quick disconnect. Weather resistant throughout. 59" overall. With 12' coax and PL-259 connector. **Model TQMA**.....**$24.95** Net.

SEND FOR LITERATURE TODAY OR

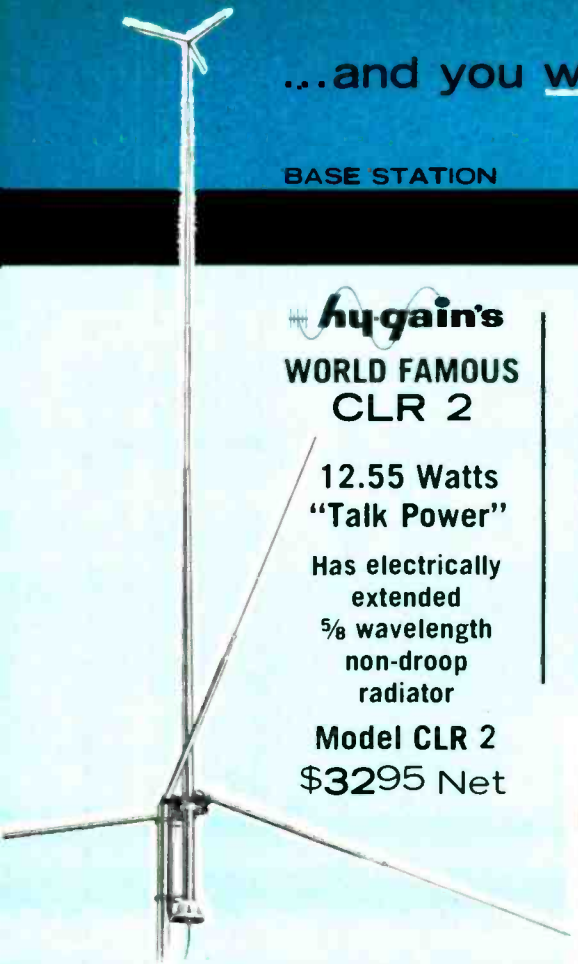
SEE YOUR HY-GAIN DEALER OR DISTRIBUTOR

HY-GAIN ELECTRONICS CORPORATION

N.E. Highway 6 at Stevens Creek, Lincoln, Nebraska 68501

...and you will find a difference

BASE STATION



hy-gain's

WORLD FAMOUS CLR 2

12.55 Watts "Talk Power"

Has electrically extended 5/8 wavelength non-droop radiator

Model CLR 2

$3295 Net

SPECIFICATIONS

ELECTRICAL

Effective Input Power	12.55 Watts
Typical SWR	Less than 1.5:1
Coaxial Feedline	52 ohm
Omni-directional pattern	

MECHANICAL

Overall Height of Radiator	19'10"
Diameter of Radiator (Tapers)	1-1/4" to 7/16"
Length of Radials	9'
Radial Diameter (Tapers)	5/8" to 5/16"
Mast Bracket Accepts	up to 1-5/8"
Wind Survival	100 MPH

GCLR2

FOR COMMERCIAL APPLICATIONS – MARINAS – COASTAL AREAS

Entire Antenna Gold Irridite Treated to Mil-Spec for lasting durability.

Model GCLR 2 $4450 Net

Same Operational Specs as CLR 2 with 120 MPH Wind Survival. (See other side for illustration)

MOBILE ANTENNAS

hy-gain's MOBILE TOPPERS with the "MARK O

All Hy-Gain Mobile Toppers have stainless steel radiator and

ROOF MOUNTS

All except TQRMB MAGNA TOPPER have single 3/8" dia. hole mount. All come complete ready to install with antenna, shock spring, mount, coax cable and PL-259 connector.

DX ROOF TOPPER
Guaranteed to outperform ANY other mobile antenna; 50" overall height. **Model TQRDX** ..... **$16.95** Net.

SHORTY ROOF TOPPER
Guaranteed to outperform any base loaded mobile antenna; only 19" overall height. **Model TRQS** ..... **$15.50** Net.

MAGNA TOPPER
Magnet base installs instantly – no holes to drill – Holds firmly at speeds over 80 MPH. Capacitively grounded. You don't remove car finish! 28" overall height. **Model TQRMB** ..... **$15.95** Net.

FENDER & COWL MOUNTS

Complete with antenna, single-hole chrome mount, coax cable and PL-259 connector.

TMCQ TOPPER
50" overall height. **Model TMCQ** ..... **$14.95** Net.

COMBINATION CB-AM/FM "DUO-TOPPER"
Replaces AM broadcast whip 50" overall height – chrome plated brass radiator – coupler precision tuned for CB; adjustable to optimum performance on AM/FM. **Model TTMPQ** ..... **$15.95** Net.

Non-telescoping Model with Stainless Radiator. **Model TMPQ** ..... **$15.95** Net.

MEANS A LOT!

Hy-Gain has always been first with new developments in basic antenna design – the kind that make a difference in performance. We introduced the first full 5/8" wave base station antenna with the first static removing "top hat". The first duo-beams were introduced by Hy-Gain. We have led the field in mobile antennas with the "mark of distinction" top loaded design, which gives unparalleled performance.

Being first is not all – we have made more improvements to every basic antenna design. WE HAVE MORE EXPERIENCE! Because of more experience, because of superiority of basic antenna knowledge, because of the world's best antenna test range, all Hy-Gain BIG SIGNAL antennas are better, electrically and mechanically!

hy-gain's

DUO-BEAMS

GET GREATEST RANGE POSSIBLE.

Uniquely designed directional antennas that compress pattern into a beam that reaches out farther than all the others.

1ST ANOTHER HY-GAIN FIRST!

hy-gain's

MOBILE "TOPPERS"

It can be seen!...when your mobile topper has the "Mark of Distinction" – the Hy-Gain TOP-LOADED antenna – the most efficient made.

TRIBUTOR

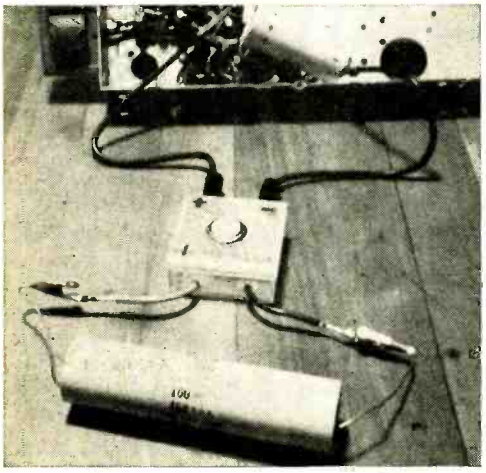
TOP SECTION OF TOPPER SHOWN ACTUAL SIZE

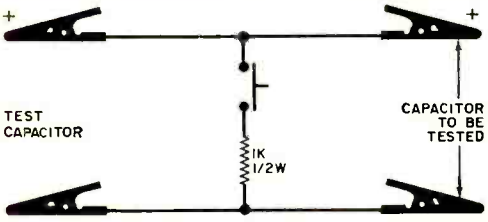
"CAPSNAPPER" ARRESTS SHOCK HAZARD AND PROTECTS ELECTROLYTICS

HAVE YOU EVER been "stung" by a not-quite-discharged electrolytic capacitor? The "Capsnapper" can take the sting out for you. It lets you conveniently jump a suspected capacitor with a good capacitor for quick test purposes, and then lets you safely discharge both capacitors after the power supply is shut off.

Construction of the "Capsnapper" is easy. Simply mount a rugged high-current momentary-type s.p.s.t. switch in a plastic box. Connect a 1000-ohm, ½-watt resistor in series with the switch, and wire both across the line as shown. One side of the "Capsnapper" goes to a good capacitor, and the other goes to the suspected capacitor in the power supply.

Be sure to observe polarity. Use insulated alligator clips just in case the capacitor in the power supply is still charged, and be sure the power supply is off when you connect the "Capsnapper." Depress the switch to drain off the charge. —*Henry R. Rosenblatt*





After power is shut off, depress switch to safely discharge both capacitors through the resistor.

NEW PRODUCTS

Additional information on products covered in this section is available from the manufacturers. Each new product is identified by a code number. To obtain further details on any of them, simply fill in and mail the coupon on page 15.

150-WATT STEREO RECEIVER KIT

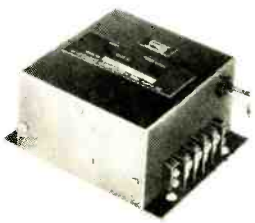
Called "the world's most advanced stereo receiver," the solid-state AR-15 *Heathkit* uses two integrated circuits in the i.f. amplifier for hard limiting, excellent temperature stability, and increased reliability. Two crystal filters replace the usual i.f. transformers—and since there are no coils, no alignment or

adjustment is ever required. Field-effect transistors are employed in the FM tuner, and there are two calibrated tuning meters: a signal strength indicator plus a special "Center-Tune" meter which puts you on exact station frequency. The AR-15 is rated at 75 watts music power per channel for an 8-ohm load, 50 watts continuous power per channel. Seven circuit boards and three wiring harnesses aid kit assembly.

Circle No. 75 on Reader Service Page 15

POWER AND POLARITY CONVERTER

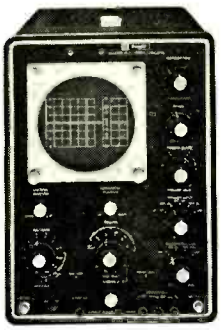
Pearce-Simpson has announced the "Power-Match" power and polarity converter, a unit that converts any automobile voltage to the 12 volts required to operate this company's solid-state CB two-way radios and other transistorized equipment. It permits negative-ground-only equipment to be operated from a 12-volt positive ground battery system. It also converts a 6-volt system (such as is used in Volkswagens) to 12 volts or to 18 volts, and 12-volt systems to 24 volts for unusual equipment requirements. The "Power-Match" is factory-wired for a 6-volt input but can be quickly and simply modified for a 12-volt input. It takes about 10 minutes to install.



Circle No. 76 on Reader Service Page 15

LABORATORY OSCILLOSCOPE KIT

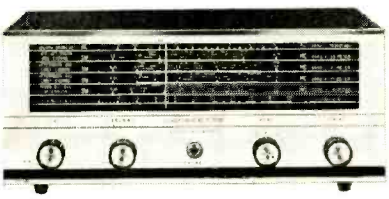
The Model KG-2100 Knight-Kit laboratory oscilloscope announced by *Allied Radio* is a d.c. to 5-MHz triggered sweep unit. Among its special features are lock-in characteristics that permit viewing stable waveform presentations even at upper frequency limits; a built-in Rotron fan for cool operation; high vertical sensitivity (5 mV/cm) for proper servicing of transistorized equipment; 85 nanoseconds rise time; horizontal response from d.c. to 800 kHz triggered sweep—200 nsec/cm down to 1 second; and regulated high- and low-voltage power supplies. The KG-2100 is also available factory-wired.



Circle No. 77 on Reader Service Page 15

FIVE-BAND SHORT-WAVE RECEIVER

Full coverage on five bands is promised for the imported "Explor-Air" Mark V short-wave receiver introduced by *Lafayette Radio Electronics*. The bands are: 0.55-1.6 MHz (medium-wave); 5.9-6.25 MHz (49 meters, international); 9.45-9.8 MHz (31 meters, short-wave); 11.45-12 MHz (25 meters, broadcast); and 15.05-15.5 MHz (19 meters). Mounted in a walnut-grained metal cabinet, the receiver is



a.c. transformer-powered, and features superheterodyne circuitry with individual tuned circuits for each band. The slide rule dial is calibrated for easy reading, and there is a built-in 4" PM speaker, rear panel connection for a short-wave antenna, and a front panel headphone jack.

Circle No. 78 on Reader Service Page 15

BATTERY-OPERATED TURNTABLE

Claimed to be ideal for use with a transistorized portable phonograph, the *Olson* Model RP-336 battery-operated turntable has two speeds. A smooth-running d.c. motor, operating on 3 volts d.c., drives the weighted turntable at 33⅓ and 45 r/min. The RP-336 is 5⅛"

CIRCLE NO. 26 ON READER SERVICE PAGE →

RCA Transistors Rectifiers Integrated Circuits

For EXPERIMENTERS HOBBYISTS HAMS and TECHNICIANS

LOOK FOR THIS DISPLAY AT YOUR RCA DISTRIBUTOR

Here displayed on the RCA Solid-State Center is the RCA SK-Series Transistors, Rectifiers, and Integrated Circuits; the new RCA 3N128 MOS Field-Effect Transistor; RCA's 40214 Silicon Stud Rectifier; and three RCA Experimenter's Kits. This new Solid-State Center, in addition to its host of devices, also includes technical literature to support the devices right on the rack. It's the "one-stop" answer to the solid-state needs of experimenter, hobbyist, ham, or the replacement requirements of the service technician.

All devices and kits are packaged in easily identifiable see-through packs for your convenience. Included with each device is broad performance data or specific ratings and characteristics where applicable.

RCA Solid-State Center Includes:

- RCA Experimenter's Kits. Three kits enable you to build a light dimmer or any one of 14 different circuits for dozens of applications around the house.
- RCA SK-Series "Top-of-the-Line" Devices: 17 Transistors, 2 Rectifiers, and 2 Integrated Circuits, for experimenter or replacement use.
- RCA Technical Manuals. Four manuals include: RCA Experimenter's Manual, RCA Transistor Manual, RCA Linear Integrated Circuits Fundamentals Manual, and RCA Tunnel Diode Manual.
- RCA Solid-State Replacement Guide. Lists all RCA SK-Series "Top-of-the-Line" Transistors, Rectifiers, and Integrated Circuits and the more than 7,300 types which they replace.

Keep RCA Experimenter's Kits and the RCA SK-Series in mind when you're shopping for solid-state devices. Look for the RCA Solid-State Center. Now at your RCA Distributor. Do it today!

RCA Electronic Components and Devices, Harrison, N.J

The Most Trusted Name in Electronics

PRODUCTS (*Continued from page 24*)

in diameter and comes with a rubber mat to protect your records.

Circle No. 79 on Reader Service Page 15

AM/FM STEREO TUNER-AMPLIFIER

Automatic stereo switching is accomplished electronically in *Channel Master's* 120-watt (peak power) solid-state AM/FM stereo multiplex tuner-amplifier, eliminating the objectionable noise created when a relay is triggered by spurious responses. In the Model 6606, automatic overload protection for the

output stages is also provided; a unique multivibrator circuit in each channel cuts off forward bias to the output transistors if the speaker terminals become accidentally shorted. Frequency response is 20 to 40,000 Hz ± 1 dB at 1 watt, 20-20,000 Hz ± 1.5 dB at rated output of 60 watts (30 watts per channel).

Circle No. 80 on Reader Service Page 15

THREE-IN-ONE WALKIE-TALKIE

Designed primarily for use as a portable heavy-duty, 5-watt walkie-talkie with 7-channel coverage, the "CARRY-COMM" introduced by *Polytronics* will also serve as a mobile radio in auto or boat, and as a portable 12-volt or 117-volt base station. Carried in a handsome leather across-the-shoulder case, the fully transistorized CARRY-COMM runs on self-contained "D" cells, or a nickel-cadmium power pack, or on its own built-in power converter.

When used as a mobile two-way radio in auto or boat, it can be fitted into an optional mounting bracket.

Circle No. 81 on Reader Service Page 15

SHORT-WAVE RECEIVER KIT

You can save almost 30% of the purchase price of *EICO's* Model 711 "Space Ranger" by building it yourself, although it is also available factory-wired. And printed-circuit board construction makes the assembly job easy. The Model 711 is a four-band, full-capability superhet, tuning from 550 kHz through 30 MHz—the 160-10 meter amateur radio bands, ship-to-shore broadcasts, weather reports, meteorologists, the Coast Guard, LORAN,

and the standard U.S. AM broadcast band. Features include a built-in ferrite rod antenna and provision for an external antenna, an S-meter, electrical bandspread tuning, a variable BFO, and an input for a Q-multiplier.

Circle No. 82 on Reader Service Page 15

SOLID-STATE CB RADIO

Twenty-one silicon transistors and six diodes are incorporated in the new *Sonar* Model J-23 Citizens Band radio. A dual-conversion unit with 23 channels, it has provisions for an external speaker and public address system.

Transmitter power output is 3.2 watts (nominal) from a 12.6-volt d.c. source for 5 watts input; an a.c. power supply is available. Other features include a selective calling system (plug-in), 100% Class B modulation, triple-amplified a.g.c., adjustable squelch, and an isolated series noise gate. Frequency stability of the J-23 is said to be better than 0.005%.

Circle No. 83 on Reader Service Page 15

REVERBERATION AMPLIFIER

To add a new dimension (echo) to your electrical guitar or sound system, you can just plug your microphone, phono pickup, guitar, etc., into *Olson Electronics'* Model RA-844 reverberation amplifier and the output of the

reverberator into your amplifier. No wiring or complicated hookup is necessary. Operating on a self-contained 9-volt battery, the RA-844 has two controls—one for volume and one for amount of reverberation.

Circle No. 84 on Reader Service Page 15

punchy galore

Was it possible to put *extra* punch, *extra* power and *extra* performance into a 5 watt CB mobile radio . . . and sell it for only $99.95? B&K, creators of the famous Cobra CAM 88, thought so—and built the new Cobra V. The 5 channel Cobra V is solid state, all-the-way. Those who have heard it and tested it say it is a most remarkable achievement in miniaturization—in CB technology—in selectivity, sensitivity and 100% modulation. It's true; this one's got punch galore. We've proven it . . . now you can. At B&K Distributors.

B&K

A DIVISION OF DYNASCAN

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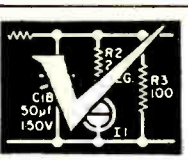
WHERE ELECTRONIC INNOVATION IS A WAY OF LIFE

CIRCLE NO. 3 ON READER SERVICE PAGE



OPERATION ASSIST

Through this column we try to make it possible for readers needing information on outdated, obscure, and unusual radio-electronics gear to get help from other *P.E. readers. Here's how it works: Check the list below. If you can help anyone with a schematic or other information,* write him directly—*he'll appreciate it. If* you *need help, send a postcard to Operation Assist,* POPULAR ELECTRONICS, *One Park Avenue, New York, N.Y. 10016. Give maker's name, model number, year of manufacture, bands covered, tubes used, etc. State specifically what you want, i.e., schematic, source for parts, etc. Be sure to print or type everything legibly, including your name and address. Because we get so many inquiries, none of them can be acknowledged.* POPULAR ELECTRONICS *reserves the right to publish only those items not available from normal sources.*

Delco Model R1128 receiver, ser. 7H709279; has 7 tubes. Schematic and source for parts needed. (Harold E. Cilley, Jr., 16027 8th N.E., Seattle, Wash. 98155)

Thordarson "Tru-Fidelity" transformers T3S22, T1A53, T2A68, T15D82. Connections and strappings needed. (Charles E. Maass, 37 Haddonfield Rd., Short Hills, N.J. 07078)

Fischer receiver; has 3 tubes (bayonet base), 2 audio transformers, and square busbar wiring. Source for tubes and other data needed. (Curt Londroche, 46 W. Iowa Ave., St. Paul, Minn. 55117)

Farnsworth-Capehart Model 610P TV receiver; has 29 tubes and 10" CRT #10FP4. Schematic and other data needed. (Mark James, Box 1079, Santa Barbara, Calif.)

U.S. Television Mfg. Corp. TV receiver, ser. 3076, chassis B. Schematic needed. (David M. Noonan, 497 Laurel Ave., Bricktown, N.J. 08723)

Atwater-Kent Model 4910 receiver. Schematic, parts list, and service data needed. (Dennis Prothero, 1276 Oakcrest, St. Paul, Minn. 55113)

GE Model J-62 receiver; tunes 540 to 1600 kHz and 5.8 to 18 MHz; has 6 tubes. Ballast tube BL42D needed. (Raymond Pritchet, 105 Barrymore Blvd., Franklin Square, N.Y. 11010)

Moss Electronic Dist Co. Model TV-50 "Genometer" signal generator. Schematic and operating manual needed. (Owen Dell, 819-37th Ave., San Francisco, Calif.)

Superior Model TV-60 meter. Schematic and source for parts needed. (Lawrence J. Pearce, 1613 Tulagi, Barstow, Calif. 92311)

Fada receiver; tunes BC; has 9 tubes. Schematic and alignment data needed. (M.R. Lynn, 10644 146 St., Edmonton, Alberta, Canada)

Delco car radio, ser. SK-7233, circa 1960; tunes BC and has "Wondabar" tunning. Schematic and knobs needed. (Stanley Jones, Box 488, Hallandale, Miss. 38748)

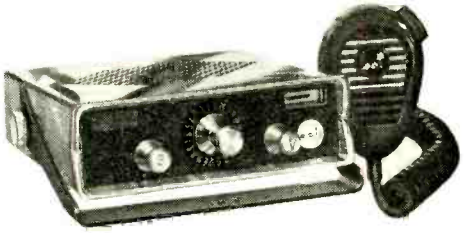
Ampro "Super Stylist" 124051 16-mm. projector. Schematic of amplifier for projector needed. (Harold G. Rosenberg, Narraganset Rd., Mohegan Lake, N.Y. 10547)

Webster frequency converter, CV-253/ALR. Schematic and operating manual needed. (Guthrie M. Hatfield, H. H. Co., 1st BN. USAECB, Ft. Belvoir, Va. 22060)

Crosley receiver, circa 1927; has 3 tubes. Source for CD12 and WD10 tubes and wiring diagram needed. (Robert D. Bolster, 62 Control St., S. Easton, Mass.)

(*Continued on page* 30)

The CB rig you can't kill.



Just $169, complete!

This is Courier's 23-channel TR-23S—the most reliable solid-state CB rig ever built. So reliable, it's GUARANTEED FOR 10 YEARS! With transmitter silicon-transistors manufactured to a higher peak voltage than ever before, plus new zener diode protection. A compact 5¾" W x 6¼" D x 1⅞" H. **Crystals supplied for all 23 channels.** Complete with microphone. Illuminated S meter. Illuminated channel selector. PA system. Auxiliary speaker jack. Single-knob tuning. Modulation indicator. DC cord. Exclusive Courier "Safety Circuit" to protect against mismatched antenna, incorrect polarity and overload. See it at your Courier dealer, or mail coupon for full data.

COURIER PORT-A-PAK®
Makes your solid-state Courier CB rig *completely portable*
Fully self-contained power pack—fits *all* Courier solid-state rigs.
$59.95

CHARGE-A-PAK®
(Battery Charger) $12.95

eci **COURIER COMMUNICATIONS, INC.**
A Subsidiary of
electronics communications inc.
56 Hamilton Avenue, White Plains, N.Y.

Yes! I'd like to know all about Courier TR-23S—the CB rig you can't kill.

☐ Send me data on PORT-A-PAK®

Name _____

Address _____

City _____ **County** _____

State _____ **Zip** _____

PE-74

ASSIST (*Continued from page 28*)

Surplus oscilloscope, OS-4/AP, ser. AS 52-1026. Schematic and operating manual needed. (Louis T. Bermann, 361 W. Cedar St., Oxnard, Calif.)

E.H. Scott receiver, circa 1940; tunes AM and FM; has 33 tubes. Servicing manual and data to convert FM portion of circuit to present frequency range needed. (J.M. Pollak, 5637 N. Haverford, Indianapolis Ind. 46220)

National Model NC100 receiver; tunes 0.54 to 30 MHz on 5 bands; has 11 tubes. Schematic and operating manual needed. (William Wheaton, 744 E. Stark Dr., Palatine, Ill. 60067)

Triumph Model 830 oscillograph wobbulator. Operating manual needed. (Steve Keleni, 180 E. Giles Rd., Thousand Oaks, Calif. 91360)

Edison cyclinder gramophone. Source for reproducer, carriage, and record holder needed. (Carl Stone, Box 892, Claresholm, Alberta, Canada)

Philco Model 70 receiver, circa 1930; tunes 550 to 1500 kHz; has 7 tubes. Schematic needed. (Roger Fox, 210 E. 7 St., Oswego, N.Y. 13126)

Zenith Model 12S268 receiver, circa 1940; tunes on 3 bands; has 11 tubes. Schematic and data for installing PM speaker needed. (Lee LaVigueur, 34979 Vickey Way, Yucaipa, Calif. 92399)

Electra "Miniphone" Model 800 CB transceiver; has 5 channels. Schematic needed. (T. W. Smith, Rt. 1, Lamons Dr., Rincon, Ga. 31326)

Sylvania Model 134 "Polymeter," ser. 3406; has 4 tubes. Schematic and parts list needed. (A. Meizis, 84 Haven St., New Haven, Conn. 06513)

Wilcox-Gay Model 5U tape recorder. Parts source and main drive belt needed. (Richard Schwall, 216 Hickory Ct., Northbrook, Ill. 60062)

Alamo amplifier, ser. 61838; has 3 tubes. Schematic and other data needed. (Thomas H. Licata, 190 Helm Ave., Wood-Ridge, N.J. 07075)

Philco Model 42-1638 receiver, code 121, chassis B97289; tunes AM and s.w. Schematic, operating manual, source for tubes and 32-8133M transformer needed. (Bradley Anbro, 119 E. Grant Highway, Marengo, Ill. 60152)

Westinghouse Model WR-328 receiver; has 7 tubes and magic eye. Cabinet needed. **Philco** Model 610 receiver; has 5 tubes. Speaker needed. (Clyde E. Propst, Rt. 2, Sellersville, Pa. 18960)

Solar Model CF capacitor analyzer. Operating manual needed. (Gilbert I. Mencher, 11356 Evans Trail, Beltsville, Md.)

Surplus Model I-166 "Volt-Ohmmeter," circa 1944. Meter and other data needed. (Charles Heick, 5537 Cleander Dr., Cincinnati, Ohio 45238)

Zenith "Trans-Oceanic" Model T-600, circa 1950; tunes 550 kHz to 18.2 MHz on 7 bands; has 6 tubes. Schematic, operating manual, and source for 50A1 tube needed. (A3C Roger Coons, Box 14318, CMR #4, Keesler AFB, Miss. 39534)

Philco Model 37-610 receiver, circa 1931; tunes BC and s.w.; has 5 tubes. Schematic and parts source needed. (C.J. Beers, 366 Katharine St., Buffalo, N.Y. 14210)

GE Model YTW-1 emission tube tester, circa 1950. Tube chart needed. (Bob Poland, 2 W. Frederick St., Piedmont, W. Va. 26750)

RCA Model 118 receiver; tunes BC and s.w.; has 5 tubes. Schematic and parts list needed. **RCA** "Radiola 66" Model AR-598 receiver; tunes 550 to 1500 kHz; has 8 tubes. Knobs needed. (Kenneth Pfitzer, 2700 Countryside Dr., Florissant, Mo. 63033)

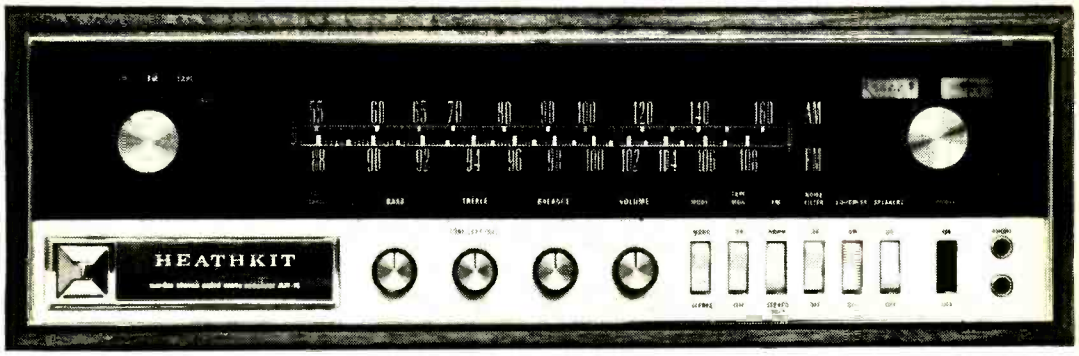
Shell "Test-O-Matic" tube tester. Schematic and tube chart needed. (E.C. Galland, Industrial Arts Dept., William H. Carr Jr. H.S., 157 St. & 17 Ave., Whitestone, N.Y. 11357)

BC 688A receiver, surplus, part of SCR 518A. Schematic and operating manual needed. (Victor Spector, Box 4150, Baker House, 362 Memorial Dr., Cambridge, Mass. 02139)

Zenith "Trans-Oceanic" Model T-600 receiver, chassis 61.40. Schematic and coil tuning data needed. (Stuart Moreau, 265 Castro St., San Francisco, Calif.)

(*Continued on page 104*)

New Heathkit® AR-15 Solid-State Stereo Receiver



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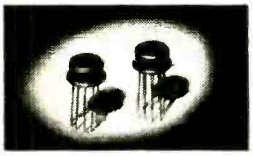
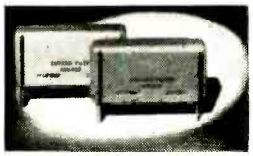


Integrated Circuits . . . two are used in the IF amplifier for hard limiting excellent temperature stability, increased reliability. Capture ratio is 1.8 db. Each IC is the size of a tiny transistor, yet each contains 10 transistors, 7 diodes, and 11 resistors.



Crystal Filters . . . two are used in the IF amplifier to replace the usual transformers . . . Heath hi-fi exclusive. Provide near-perfect bandpass characteristics, (70 db selectivity) yet no adjustment is ever needed!

Now From The World's Most Experienced Solid-State Audio Engineers Comes The World's Most Advanced Stereo Receiver . . . The New Heathkit AR-15. There's nothing like it anywhere in the transistor stereo market place. Besides the use of space-age integrated circuits and exclusive crystal filters in the IF section, it boasts other "state-of-the-art" features like these:

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† Kit AR-15, (less cabinet) 28 lbs. **$329.95**
AE-16, assembled wrap-around walnut cab., 7 lbs. **$19.95**

AR-15 SPECIFICATIONS — AMPLIFIER SECTION: Dynamic Power Output Per Channel (Music Power Rating): 8 ohm load; 75 watts. **Continuous Power Output, Per Channel*:** 8 ohm load; 50 watts. **Power Bandwidth For Constant 0.5% Total Harmonic Distortion*:** 6 Hz to 25 kHz. **Frequency Response (1 watt level):** ±1 db, 6 to 50,000 Hz. ±3 db, 4 to 70,000 Hz. **Harmonic Distortion:** Less than 0.5% from 20 to 20,000 Hz at 50 watts output. Less than 0.2% at 1,000 Hz with 50 watts output. Less than 0.2% at 1,000 Hz with 1 watt output. **Intermodulation Distortion (60 Hz: 6,000 Hz=4:1)** Less than 0.5% with 50 watts output. Less than 0.2% with 1 watt output. **Damping Factor:** 45. **Hum & Noise:** Volume control at minimum position; —80 db. PHONO; **Channel Separation:** PHONO; 45 db. TAPE & AUX.; 55 db. **Output Impedance (each channel):** 4, 8 & 16 ohms. **FM SECTION (Mono): Sensitivity:** 1.8 uv*. **Frequency Response:** ±1 db, 20 to 15,000 Hz. **Antenna:** Balanced input for external 300 ohm antenna, unbalanced, 75 ohm. **Volume Sensitivity:** Below measurable level. **Selectivity:** 70 db*. **Image Rejection:** 90 db. **IF Rejection:** 90 db minimum*. **Capture Ratio** 1.5 db*. **AM Suppression:** 50 db*. **Harmonic Distortion:** 0.5% or less*. **Intermodulation Distortion:** 0.5% or less*. **Hum & Noise:** 65 db*. **Spurious Rejection:** 100 db*. **FM SECTION (Stereophonic): Channel Separation:** 40 db or greater. **Frequency Response:** ±1 db, 20 to 15,000 Hz. **Harmonic Distortion:** Less than 1% at 1,000 Hz with 100% modulation. **19 & 38 kHz Suppression:** 55 db or greater. **SCA Suppression:** 50 db. **AM SECTION: Sensitivity:** 12 microvolts at 1,000 kHz. **Image Rejection:** 60 db at 600 kHz. 40 db at 1400 kHz. **IF Rejection:** 70 db at 1,000 kHz. **Harmonic Distortion:** Less than 1.5% at 400 Hz, 90% modulation. **Hum & Noise:** 45 db. **Power Requirements:** 105-125 or 210-250 volt 50/60 Hz AC. **Dimensions:** Overall, 16⅞" wide x 4¾" high x 14½" deep.

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GRA-295-1, walnut cabinet (shown above) 56 lbs. . . 19" D. x 31" H. x 34½" W. **$62.95**
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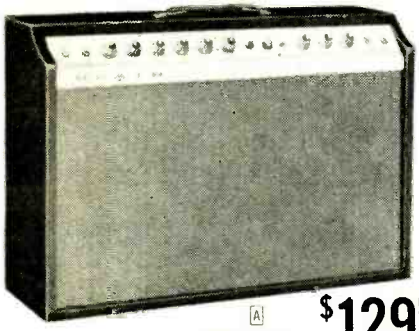

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60 watts peak power; two channels — one for accompaniment, accordian, organ, or mike, — the other for special effects . . . with both variable reverb and tremolo; 2 inputs each channel; two foot switches for reverb & tremolo; two 12″ heavy-duty speakers; line bypass reversing switch for hum reduction; one easy-to-build circuit board with 13 transistors, 6 diodes; 28″ W. x 9″ D. x 19″ H. leather-textured black vinyl cabinet of ¾″ stock; 120 v. or 240 v. AC operation; extruded aluminum front panel. 52 lbs.

American Made Harmony-By-Heathkit Guitars

All wood parts factory assembled, finished and polished . . . you just mount the trim, pickups and controls in predrilled holes and install the strings . . . finish in one evening.

These Valuable Accessories Included With Every Guitar Kit

Each guitar includes vinylized chipboard carrying case, cushioned red leather neck strap, connecting cord, Vu-Tuner® visual tuning aid, tuning record, instruction book and pick . . . worth $19.50 to $31.50 depending on model.

[B] Deluxe Guitar . . . 3 Pickups . . . Hollow Body

Double-cutaway for easy fingering of 16 frets; ultra-slim fingerboard — 24¼″ scale; ultra-slim "uniform feel" neck with adjustable Torque-Lok reinforcing rod; 3 pickups with individually adjustable pole-pieces under each string for emphasis and balance; 3 silent switches select 7 pickup combinations; 6 controls for pickup tone and volume; professional Bigsby vibrato tail-piece; curly maple arched body — 2″ rim — shaded cherry red. 17 lbs.

[B] Kit TG-46
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[C] Kit TG-26
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[D] Kit TG-36
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[C] Silhouette Solid-Body Guitar . . . 2 Pickups

Modified double cutaway leaves 15 frets clear of body; ultra-slim fingerboard — 24¼″ scale; ultra-slim neck for "uniform feel"; Torque-Lok adjustable reinforcing rod; 2 pickups with individually adjustable pole-pieces under each string; 4 controls for tone and volume; Harmony type 'W' vibrato tail-piece; hardwood solid body, 1½″ rim, shaded cherry red. 13 lbs.

[D] "Rocket" Guitar . . . 2 Pickups . . . Hollow Body

Single cutaway style; ultra-slim fingerboard; ultra-slim neck, steel rod reinforced; 2 pickups with individually adjustable pole-pieces for each string; silent switch selects 3 combinations of pickups; 4 controls for tone and volume; Harmony type 'W' vibrato tailpiece; laminated maple arched body, 2″ rim; shaded cherry red. 17 lbs.

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101 QUESTIONS & ANSWERS ABOUT TRANSISTORS

by Leo G. Sands

Although many volumes have been written about transistor theory and semiconductor physics, this book is designed for students, experimenters, and technicians who want a better working knowledge of transistors and what they can do. It answers the most frequently asked questions about transistors and their applications in a simple, straightforward manner. No attempt has been made to include mathematics or discussions of atoms, electrons, etc., but schematics, graphs, and photographs are frequently used to illustrate the answers. Part 1 covers basic transistor types, functions, characteristics, and testing, while Parts 2-5 cover the various applications. A handy reference volume.

Published by Howard W. Sams & Co., Inc., 4300 West 62 St., Indianapolis, Ind. 46206. Soft cover. 112 pages. $2.25.

COMPUTER DESIGN

by Ivan Flores

The technology surrounding the design and application of computers has necessitated the development of a specialized "language." This book—planned as a classroom text at the two-year technical institute level—reveals the design and structure of digital computers. It begins by interpreting just what is involved in a computer system and progresses —with adequate explanations—to the "fetch" cycle, circuitry, parity, bit site, etc. This is an excellent book for a student familiar with solid-state circuitry who needs information as to how these circuits are employed in digital computers and simultaneously needs to be able to discuss computers on an intelligent basis.

Published by Prentice Hall, Inc., Englewood Cliffs, N.J. Hard cover. 464 pages. $14.00.

RCA RECEIVING TUBE MANUAL, RC-25

If vacuum tubes are dying out, someone forgot to tell the RCA people. This perennially favorite handbook contains 32 more pages than the last edition and includes revised tube data, circuit suggestions, and new text material on basic tube functions.

Published by Electronic Components and Devices, Radio Corporation of America, Harrison, N.J. Soft cover. 608 pages. $1.25. —30—

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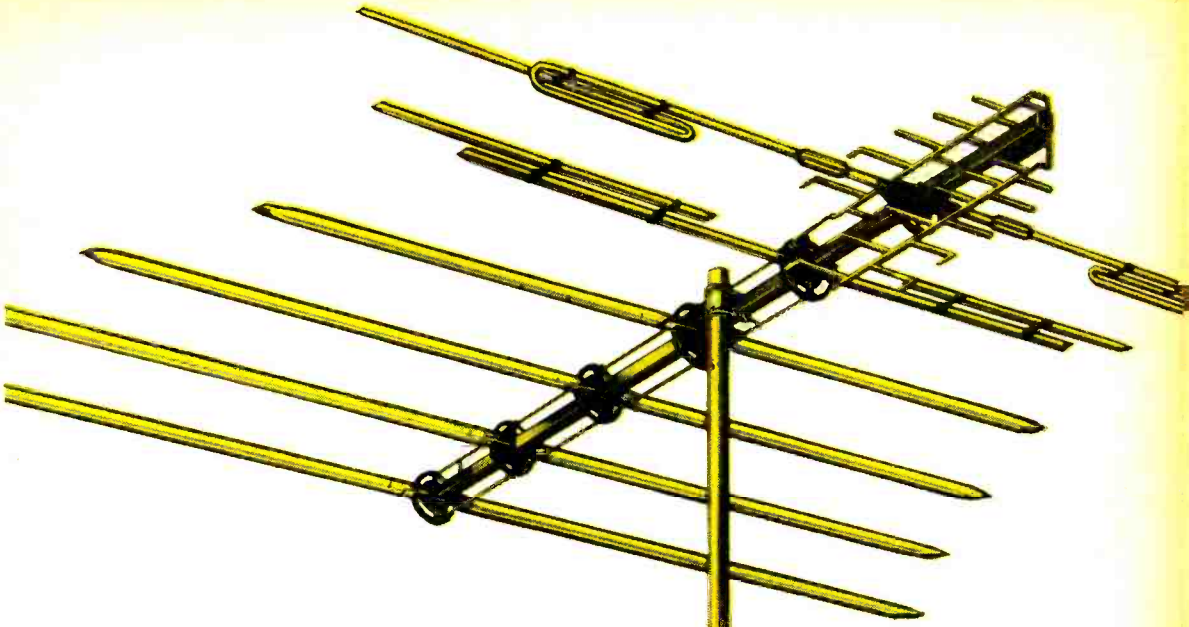

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Circle No. 85 on Reader Service Page 15

Complete details are available on an improved radio-controlled garage door opener system just announced by *The Alliance Manufacturing Co., Inc.* Called the "Genie Model 401," the unit features a built-in time delay for the garage light which automatically provides illumination for a short period of time after the door is closed.

Circle No. 86 on Reader Service Page 15

The *Sencore* Bulletin No. 338, a 4-page, 2-color brochure, illustrates and describes six new test instruments: the CG10 and CG138 "Lo-Boy" standard color bar generators; MX11 "Channelizer" FM-stereo multiplex generator; TR139 in-circuit transistor tester; SM-112B "Service Master," a 2-in-1 VTVM/VOM; and the MU140 "Continental" mutual conductance tube tester.

Circle No. 87 on Reader Service Page 15

Technicians will find a wide choice of tube testers, a solid-state color signal generator, VTVM, VOM, component substitutor, CRT tester-rejuvenator, in-circuit capacitor tester, and an r.f. signal generator in the 16-page 1967 catalog announced by *Mercury Electronics Corporation*. In addition, many wire-it-yourself kits are featured.

Circle No. 88 on Reader Service Page 15

Amperex Electronic Corporation has available a new 20-page "Condensed Components Catalog" containing descriptions and basic specifications for its complete line of capacitors (electrolytic, foil, ceramic, and variable), resistors (linear and non-linear), speakers, and knobs.

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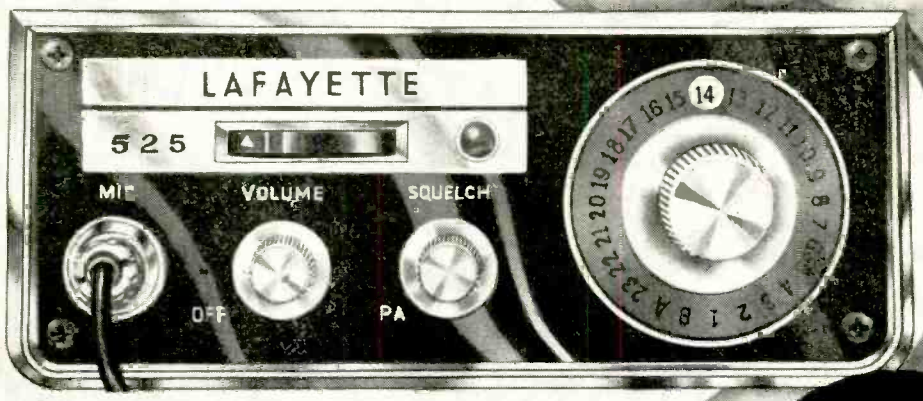

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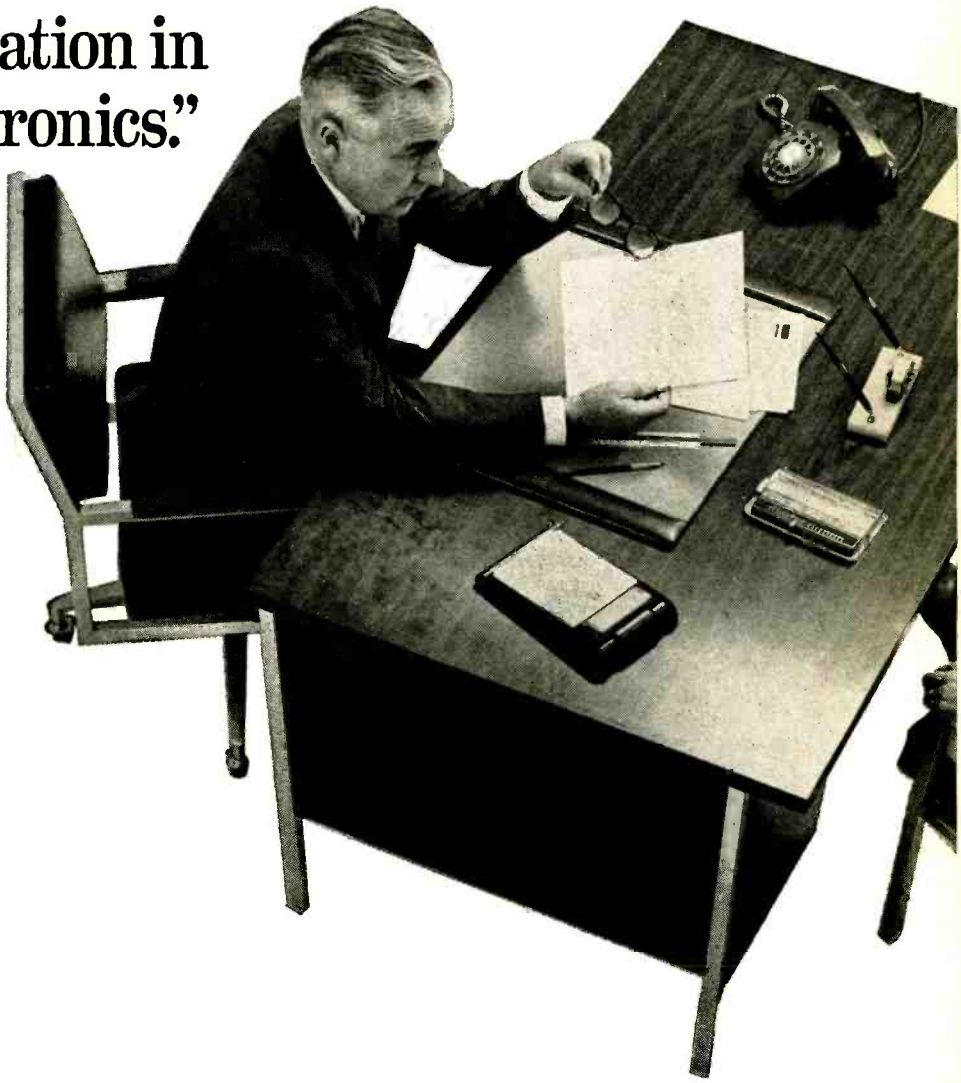

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The C-12B is more than a frequency standard — it measures power output, measures AM modulation, and is a signal generator . . . all self contained in one convenient unit.

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- *AM Modulation Measurement* — Range 0 to 100%. Accuracy 3% @ 400 CPS @ 80% modulation.
- *Signal Generator* — Frequency range 26.965 mc to 27.255 mc. Low output 1 microvolt through special pick-off box furnished with meter. High output 100 microvolts through output jack.
- *Panel Controls* — Channel selector, 24 positions • "Hi-Lo" frequency adjust • RF level control • Modulation set • Power • Meter calibration adjust • Function selector, 7 positions • Modulation • RF • Deviation • Calibration • Battery Test "A" • Battery Test "B" • Battery Test "C".
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The C-12B is capable of holding 24 crystals and comes with 23 crystals installed. Everything you need including connecting cable, PK box, dummy load, and batteries.

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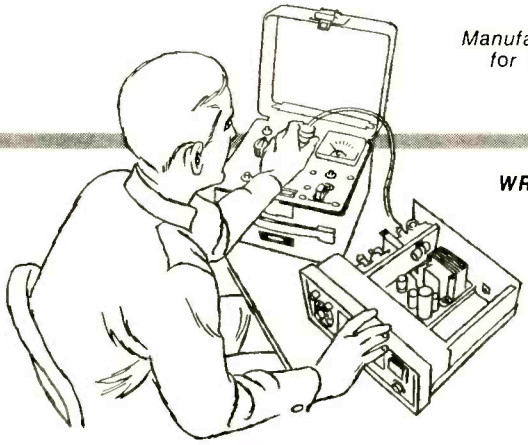

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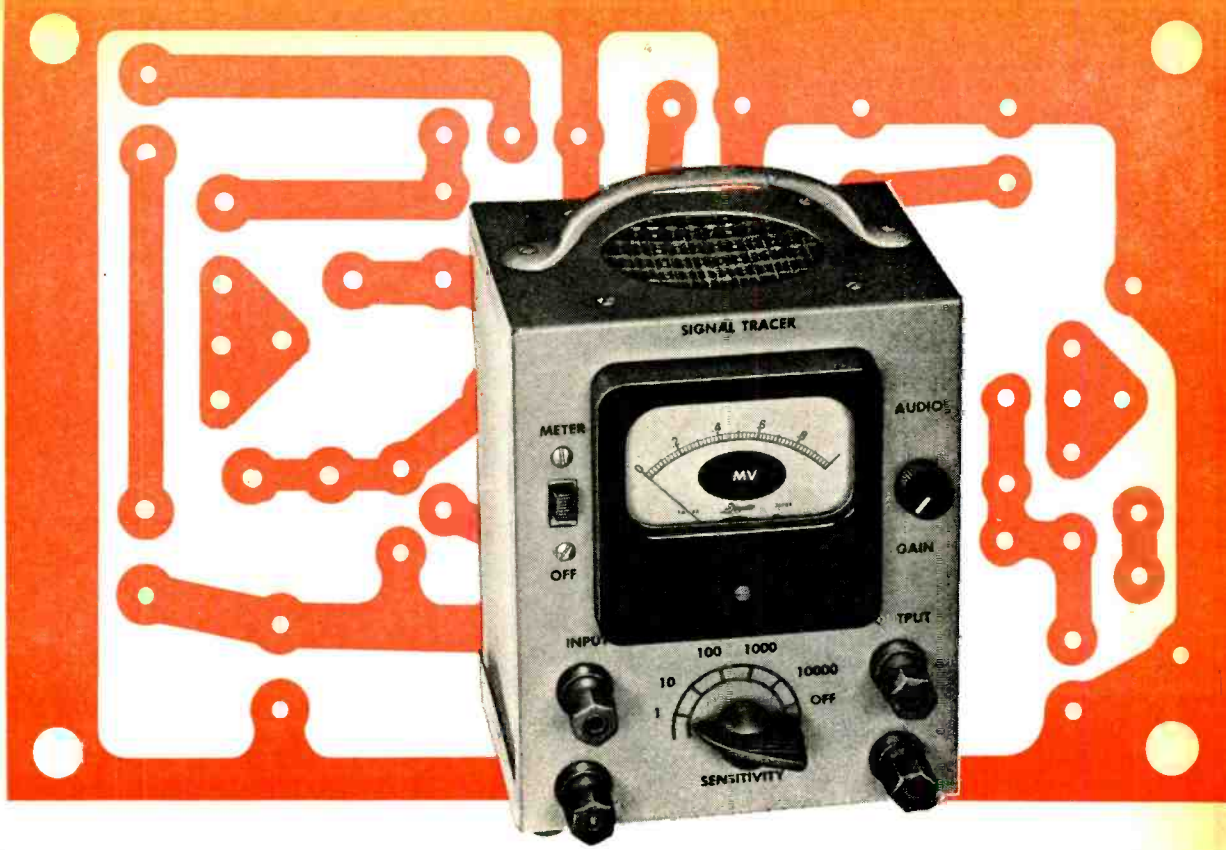

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COVER STORY

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By JAMES RANDALL

HERE'S a honey of a signal tracer you can build for less than the cost of an ordinary commercial unit, and yet is so versatile you can use it as a millivoltmeter, output meter, microphone preamplifier, auxiliary audio amplifier for tests and experiments, tape recorder monitor and, of course, as a sensitive and accurate signal tracer for testing and trouble-shooting audio- and radio-frequency circuits.

The advanced circuitry, featuring a field-effect transistor (FET) to achieve high input impedance and prevent circuit loading, includes a high-gain transistor preamplifier and a packaged imported audio amplifier that provide so much gain you can trace a signal right up to the very input of a receiver with a demodulator probe. Test results can be monitored visually on a panel voltmeter, externally on a scope, or aurally on a built-in speaker or optional headphones.

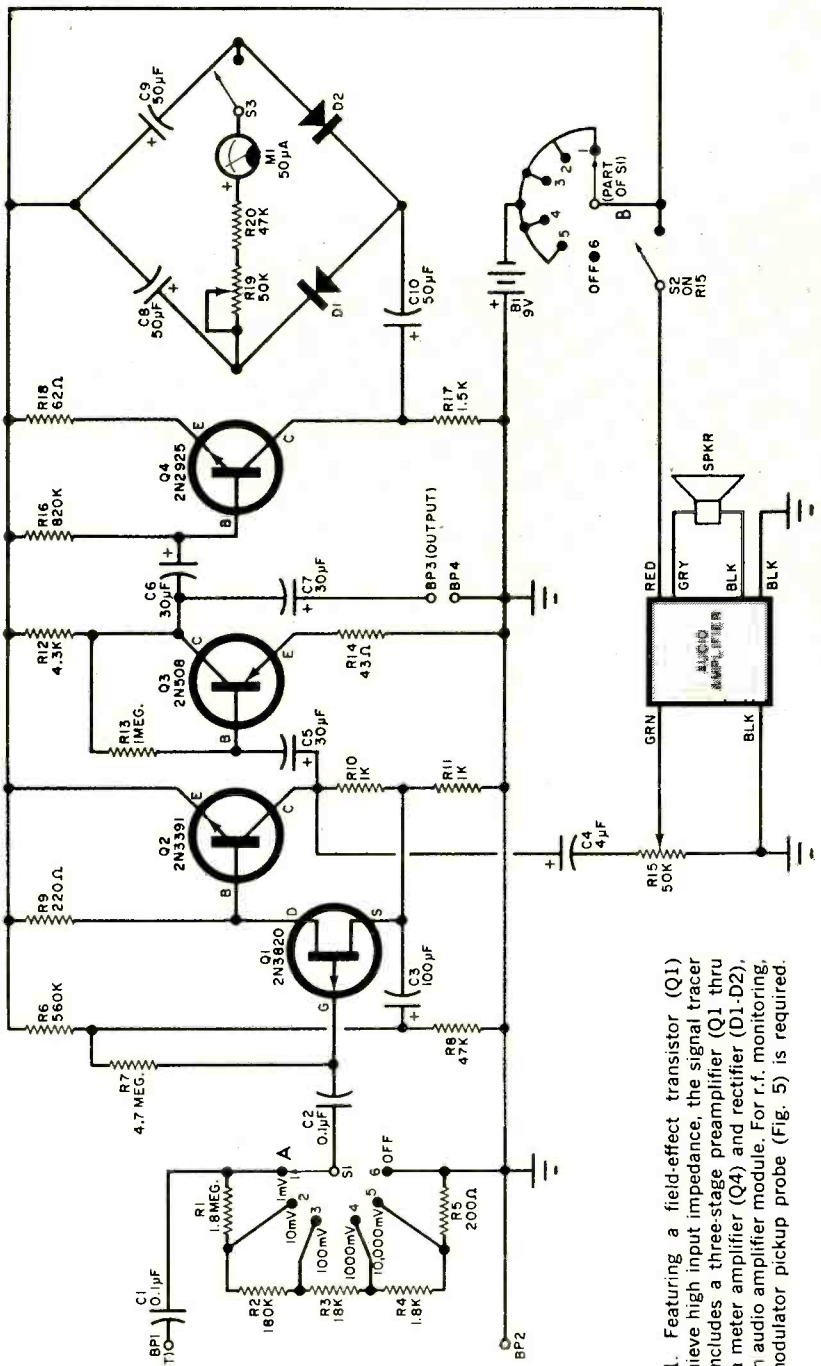


Fig. 1. Featuring a field-effect transistor (Q1) to achieve high input impedance, the signal tracer also includes a three-stage preamplifier (Q1 thru Q3), a meter amplifier (Q4) and rectifier (D1-D2), and an audio amplifier module. For r.f. monitoring, a demodulator pickup probe (Fig. 5) is required.

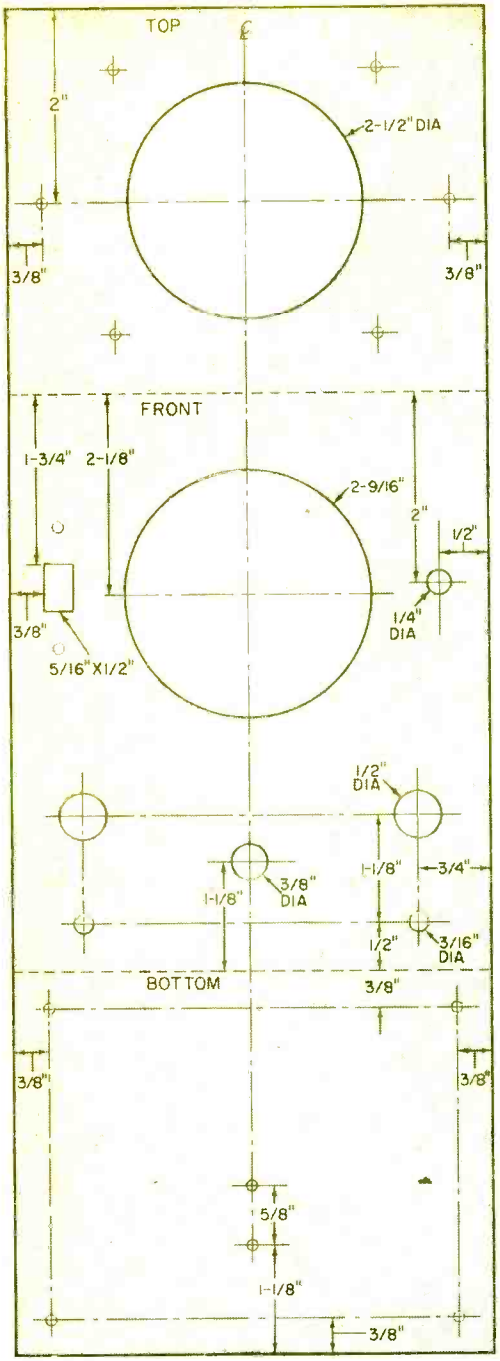


Fig. 2. If you use the recommended-size utility cabinet, you can follow these dimensions when you lay out the cabinet. Compare your speaker and meter sizes with the respective cutouts before punching any holes.

SPECIFICATIONS

Input Impedance	2 megohms
Voltage Range	100 μV to 10 volts
Preamplifier Voltage Gain	200
Audio Amplifier Output Power	100 milliwatts
Power Requirements	9-volt battery

PARTS LIST

B1—9 volt transistor battery
BP1, BP2, BP3, BP4—5-way binding post
C1, C2—0.1-μF, 100-volt capacitor
C3—100-μF, 6-WVDC, miniature electrolytic capacitor
C4—4-μF, 12-WVDC, miniature electrolytic capacitor
C5, C6, C7—30-μF, 12-WVDC, miniature electrolytic capacitor
C8, C9, C10—50-μF, 6-WVDC, miniature electrolytic capacitor
D1, D2—1N60 germanium diode
M1—3" meter, 0-50 μA (Lafayette 99 C 5042 or similar)
Q1—2N3820 field effect transistor
Q2—2N3391 transistor
Q3—2N508 transistor
Q4—2N2925 transistor
R1—1.8 megohms, ± 5%
R2—180,000 ohms, ± 5%
R3—18,000 ohms, ± 5%
R4—1800 ohms, ± 5%
R5—200 ohms, ± 5%
R6—560,000 ohms
R7—4.7 megohms
R8—47,000 ohms
R9—220 ohms, ± 5%
R10, R11—1000 ohms, ± 5%
R12—4300 ohms
R13—1 megohm
R14—43 ohms
(all resistors ½-watt)
R15—50,000-ohm potentiometer (with switch S2)
R16—820,000 ohms
R17—1500 ohms
R18—62 ohms
R19—50,000-ohm potentiometer
R20—47,000 ohms—see text
S1—2-pole, 6-position miniature switch
S2—S.p.s.t. switch (on R15)
S3—S.p.d.t. slide switch
1—100-mW, 4-transistor, imported audio amplifier (Lafayette 99 C 9042 or similar)
1—6" x 5" x 4" utility cabinet
Misc.—Rubber feet (4), ¼"-long #6 spacers (2), handle, grille cloth, pointer knob for S1, circuit board, wire, solder, battery clip, etc.
Accessories—Oscilloscope demodulator probe (1); oscilloscope direct probe (1)

USING THE SIGNAL TRACER

To signal-trace the r.f. and i.f. stages of a receiver, use a demodulator probe at the input binding posts. Set the dial of the receiver under test to a local station, or apply a signal at the receiver input using a signal generator. Then turn the receiver on.

For aural signal-tracing turn on the signal tracer, set its sensitivity control to 1 mV, and advance the volume control as necessary for comfortable listening. Starting at the receiver antenna coil, touch the probe tip in turn to the input and output of each stage in the receiver through the audio section. When you lose the signal, the difficulty lies in the stage just preceding the last test point. You can get an indication of the gain of each stage by the amount the sensitivity and gain controls must be reduced to maintain equal volume.

For visual monitoring, the audio amplifier can be turned off and the signal voltage read on the panel millivoltmeter, or on a scope connected at the output binding posts. You can also monitor the incoming signal at these binding posts with a pair of headphones.

To use the signal tracer as an audio amplifier for a microphone, tape recorder, phonograph, etc., connect the source to the input terminals with a shielded cable or direct probe, and use either the internal speaker or external remote speaker for listening.

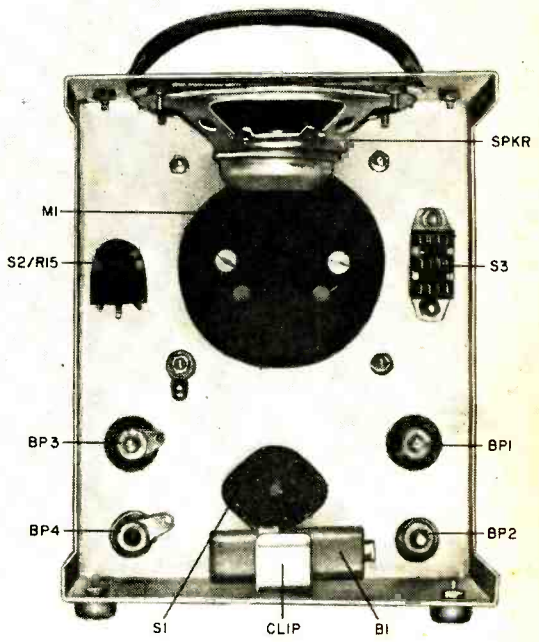
Circuit Description. The signal tracer (Fig. 1) consists of a step attenuator (*R1* through *R5*), a three-stage preamplifier (*Q1* through *Q3*), a meter amplifier (*Q4*) and bridge, and a packaged audio amplifier and speaker.

An input signal is attenuated as necessary by the setting of *S1* before it is applied, through *C2*, to the gate of FET *Q1*, biased by *R7*. The amplified output at *Q1*'s drain is direct-coupled to the base of *Q2*, biased by the drop across *R9*. The output at the collector is fed through *C5* to the base of *Q3*, biased by *R13*, and to the audio amplifier module through *C4* and gain control *R15*.

A signal at *Q3*'s collector can be monitored at OUTPUT binding posts *BP3* and *BP4*, across coupling capacitor *C7*, and is also fed through *C6* to the base of *Q4*, biased by *R16*. The amplified output at the collector is applied through *C10* to the bridge rectifier and the meter (*M1*) circuit for measurement.

The entire unit is powered by a 9-volt transistor battery, controlled by *S1* and *S2*. Switch *S3* serves to disconnect *M1* from the circuit when the meter is not in use. Potentiometer *R19*, in series with limiting resistor *R20*, permits easy calibration of the meter.

Fig. 3. After you have laid out the cabinet, and drilled or punched out the necessary mounting holes, secure the carrying handle and then install the speaker, meter, and other components shown.



Since a 50-μA meter must be used for *M1*, its scale has to be replaced with that of a 1-mA meter, or recalibrated for 1-mV full scale. The dial can be calibrated simultaneously with the unit after assembly.

Construction. Lay out and drill the holes in the metal cabinet according to the dimensions given in Fig. 2. If you

plan to use a larger cabinet or a different voltmeter, be sure to make the necessary changes in the dimensions before proceeding with the construction.

After drilling and cutting the holes, deburr them using a fine file, and then spray on a coat or two of light gray paint and allow it to dry thoroughly. Label all controls and binding posts with decal lettering, then seal the lettering with a few coats of clear plastic spray or clear lacquer.

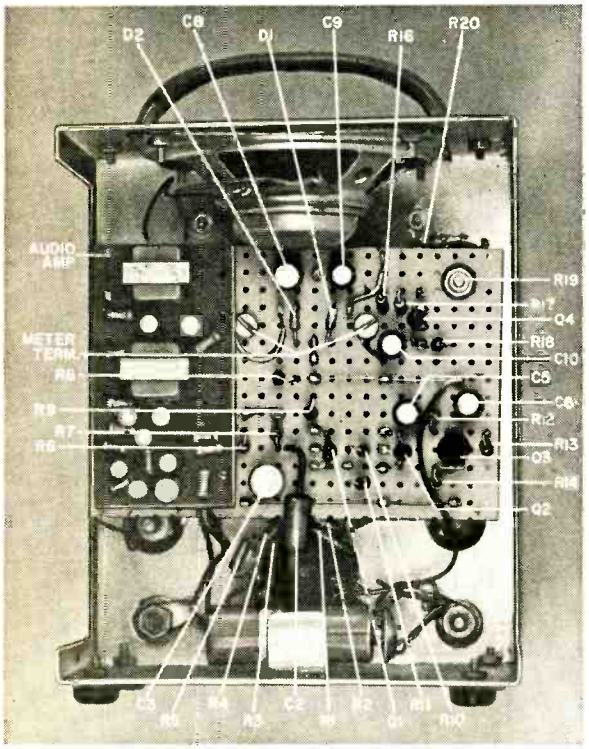


Fig. 4. Layout is not critical but do not dress the input and output leads near each other, to prevent feedback. You can rearrange the parts as you wish for improved appearance. Resistors R1 through R5 are mounted directly on S1.

Refer to Fig. 3 and install the handle, speaker and grille, rubber feet, battery clip, voltmeter, binding posts and switches as shown. Before you install switch *S1*, it must be prewired and assembled with the attenuator resistors (*R1* through *R5*) in accordance with Fig. 1. Observe, also, that *S2* is mounted on potentiometer *R15*.

Mount the audio amplifier module on one side of a 4¾" x 3" perforated circuit board (see Fig. 4), isolating the amplifier with ½"-long standoff spacers. Assemble the circuit board following any convenient layout. The one shown can be used as a guide. Keep all leads as short as possible, and avoid crossing input and output circuits to insure against oscillation.

Potentiometer *C19* and capacitors *C4* and *C7* are mounted on the underside of the circuit board. The easiest way to handle this mounting problem is to connect one end of each capacitor to the board before it is mounted, and connect the other end after the circuit board is in place. *Be sure to observe all capacitor and diode polarities.*

Using the terminal screws that come with the meter, secure the circuit board to the back of the meter housing with ¼" spacers between the two surfaces to isolate the board from the meter. Complete the rest of the point-to-point wiring, following the schematic (Fig. 1). Now install the battery.

Check the unit for overall operation by applying a signal at the input and observing the meter deflection, or try monitoring the signal at the loudspeaker with all controls on.

Calibration. To calibrate the signal tracer, flip meter switch *S3* to its *on* position, turn off the audio switch on the GAIN control, and set the SENSITIVITY switch to 1 mV.

Apply a 1-kHz, 1-mV signal to the INPUT jacks, and adjust potentiometer *R19* for full-scale deflection. If the meter pegs, or if full-scale deflection is obtained with *R19* set to maximum resistance, increase the value of *R20* as necessary to obtain 1-mV full-scale deflection with *R19* at mid-range. If, on the other hand, full-scale deflection cannot be achieved with *R19* at mid-range, reduce the value of *R20* as necessary. Lock or seal the calibration pot (*R19*) without disturbing its setting.

If precision resistors were used for *R1* through *R5*, the calibration for the

(*Continued on page* 103)

WHAT YOU SHOULD KNOW ABOUT

TV COLOR BAR GENERATORS

THERE'S A WIDE CHOICE OF EQUIPMENT AVAILABLE TO KEEP THE MULTI-MILLION COLOR TV SET VIEWERS HAPPY

By ROBERT CORNELL, Managing Editor

MILLIONS of color TV sets are now in use, and many millions more will be installed in the very near future. Except for the fact that special attention has to be paid to the color circuits and the color picture tube, installation and servicing of color TV sets is essentially the same as for black-and-white TV sets. But there's a need for additional test equipment specifically designed for color TV receiver work.

In order to properly adjust the chroma circuits, and the "firing" of the three guns inside the color picture tube, to obtain good black-and-white as well as good color pictures, it is necessary to work with certain signals to set up a display of suitable test patterns on the CRT. The most used test patterns are: horizontal and vertical lines for linearity and dynamic convergence adjustments; dot pattern to pinpoint static convergence adjustments; and color bar patterns to facilitate troubleshooting and adjusting color-phasing, matrixing and other chroma circuits. The one instrument able to furnish these test patterns is a TV color bar generator.

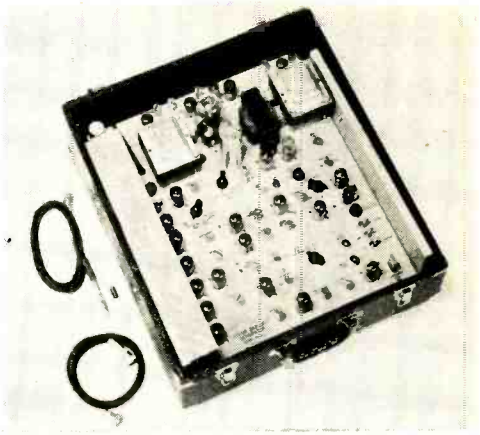
What's Available. Test equipment manufacturers offering one or more models of color bar generators for home use number about a baker's dozen. Two kits are available: one from Allied Radio Corp., and the other from the Heath Co., priced at $89.95 and $64.95 respectively. Factory-wired units start at $89.95. More than half of the models sell for less than $150. Both tube and solid-state versions are available.

Most of the units generate an offset carrier signal to produce a gated rainbow color bar pattern. Only EICO, Hickok and Jackson generators provide an NTSC signal. Hickok has two such generators, one at $349.50 and the other at $549.50. Jackson's unit at $149.95, and EICO's at $169.00 seem like a breakthrough in price for this type of equipment. There are no NTSC generators available in kit form.

Amphenol's generator is unique because of its single line and dot output. Lectrotech's Model V7 is also in a class by itself with its built-in vectorscope. Another unusual instrument is B&K's Model 1076. It is more an analyst type of instrument than just a color bar generator, and is not listed in the "Guide to TV Color Bar Generators" on pages 50 and 51. Selling for $329.95, it can generate just about every type of signal needed to service a black-and-white or color TV set. Monochrome test patterns printed on transparent slides can be in-

Only two generators are available in kit form. Allied Radio's Knight-Kit (Model KG-685, center) is a solid-state instrument. Heath's vacuum-tube job (Model IG-62, right) is the lowest priced unit in the field. Both units feature a gray-scale tracking pattern.

New solid-state NTSC signal generators from EICO (Model 380, left) and Jackson (Model X-100, below) may very well make the use of NTSC test signals more popular. Hickok's Model 656XC (right) has long been a reliable standard, but its weight and price make it more of a lab instrument.



serted into the instrument, scanned by a built-in TV pickup, and fed out to a TV set under test.

Most generators provide an r.f. signal (usually on Channels 3, 4, and 5); some also put out a video signal; and some have a 4.5-MHz audio carrier signal. A few provide all three types of signals. Some generators have gun killers, and some have a separate outlet for sync signals. Several generators provide a special pattern for gray-scale tracking.

The number and type of controls built into these generators contribute to their utility, versatility, and ease of handling. Most of the control functions are self-explanatory. There are r.f. and video gain controls, spot-size controls, sync controls, brightness controls, and function controls. Some controls are ganged to perform more than one function, and the names of the same controls are not the same on all pieces of equipment.

As with any type of test equipment, especially where there is such a large

RAINBOWS AND RASTERS

NTSC Signal. National Television Systems Committee (NTSC) specifications call for a 3.58-MHz (3.579545-MHz) signal whose phase is varied with the instantaneous hue of the televised color, and whose amplitude is varied with the instantaneous saturation of the color.

Keyed Rainbow Signal. A 3.56-MHz (3.563795-MHz) continuous sine-wave signal from a color bar generator that is pulsed on and off. This signal creates a series of different color bars on the screen of the color picture tube. A typical pulse rate (for 10 color bars) is 12 times per one horizontal line.

Offset Carrier. The 3.56-MHz carrier (signal) from the color bar generator is offset (differs) from the 3.58-MHz signal from the color burst oscillator in the TV set by an amount equal to the horizontal line frequency (15,750 Hz). A 0° to 360° phase change occurs between these two signals during the time it takes to scan one horizontal line. The phase shift at a given point on one horizontal line is the same for all points directly above or below that given point on the other horizontal lines. Thus, if a 90° phase shift causes a red spot on the horizontal lines, a vertical red line will appear on the screen.

Clear Raster. A quiet (free of snow) raster such as would be obtained in the absence of a video signal on either the cathodes or the grids of the three guns in the CRT (mostly a function of bias conditions). Some color bar generators set up a clear raster simply by modulating the r.f. carrier with vertical and horizontal sync pulses only. Under these circumstances, the chroma circuits—including the color killer—are off, as though the TV set were receiving a monochrome transmission.

Chroma Clear Raster. Also called a white raster, this looks like a clear raster but each of the three guns in the CRT is operating under the influence of a color level determined by a white video signal. In this case, all TV set chroma circuits are working as though the TV set were receiving a color transmission of a completely white scene.

Manufacturer	OUTPUTS							
	Model	TV Channel(s)	Video	Audio Carrier (4.5 MHz)	Sync	Color	Cross-hatch	Vertical Lines
ALLIED RADIO CORP. 100 N. Western Ave. Chicago, Ill. 60680 (Knight-Kit)	KG-685	3, 4, 5	yes	yes	yes	gated rainbow	yes	yes 9
AMPHENOL DIST. DIV. Amphenol Corp. 2875 S. 25th Ave. Broadview, Ill.	860	3, 4	yes	no	no	gated red, blue, green-blue	yes	yes 20
B & K DIVISION Dynascan Corp. 1801 W. Belle Plaine Ave. Chicago, Ill.	1245	3, 4, 5	no	no	no	gated rainbow	yes	yes 10
EICO ELECTRONIC INSTRUMENT CO., INC. 131-01 39th Ave. Flushing, N. Y.	380	3	yes	no	no	NTSC	yes	yes 10
HEATH COMPANY Benton Harbor, Mich. 49022	IG-62	2-6	yes	yes	no	gated rainbow	yes	yes 12
HICKOK ELECTRICAL INSTRUMENTS CO. 10514 Dupont Ave. Cleveland, Ohio	656XC	2-6	yes	yes	no	NTSC	yes	yes 20
	660	2-6	yes	no	no	NTSC	yes	yes 20
	661	3, 4	yes	no	no	NTSC	yes	yes 20
	662	all see text	no	no	no	fixed 1 color bar	yes	yes 18
	GC-660	3, 4, 5	yes	yes	yes	gated rainbow	yes	yes 18
JACKSON ELECTRICAL INSTRUMENT CO. 35 Windsor Ave. Mineola, N. Y. 11501	X-100	2-5	yes	no	no	NTSC	yes	yes 20
LECTROTECH INC. 1221 W. Devon Ave. Chicago, Ill. 60626	V6B	3, 4, 5	yes	no	no	gated rainbow	yes	yes 12
	V7	3, 4, 5	yes	no	no	gated rainbow	yes	yes 12
MERCURY ELECTRONICS CORP. 315 Roslyn Rd. Mineola, N. Y. 11501	1900	3, 4, 5	no	no	no	gated rainbow	yes	yes 10
PRECISE ELECTRONICS DIV. Designatronics Inc. 76 E. Second Mineola, N. Y.	660	3, 4, 5	no	yes	no	gated rainbow	yes	yes 10
RADIO CORPORATION OF AMERICA 415 South Fifth St. Harrison, N. J.	WR-64B	3, 4	no	yes	no	gated rainbow	yes	no
SECO ELECTRONICS CORP. 1201 S. Clover Dr. Minneapolis, Minn. 55420	900	2, 3, 4	no	no	no	gated rainbow	yes	yes 9
	980	2, 3, 4	no	no	no	"	yes	yes 9
	990	2, 3, 4	no	no	no	"	yes	yes 9
SENCORE 426 S. Westgate Drive Addison, Ill. 60101	CG-10	2-6	no	no	no	gated rainbow	yes	yes 10
	CG-12	2-6	no	no	no	"	yes	yes 10
	CA-122B	2-6 20-50 MHz i.f. output	yes	yes also 900 Hz	yes	"	yes	yes 10
	CG-126	3, 4, 5	no	no	no	"	yes	yes 10
	CG-135	3, 4, 5	yes	yes	yes	"	yes	yes 10

BAR GENERATORS

PATTERNS							PHYSICAL DATA			
Horizontal Lines	Dots	Adj. Size	Gain Control	Other	Gun Killers	Tubes or Solid State	Size (inches)	Weight (pounds)	Power Type	Price ($)
yes 14	yes	no	yes	shading bars clear raster	yes	solid state	4⅝×12×9⅝	12	line	89.95 kit
yes 15	yes	no	yes	single horiz. & vert. lines, centered crosslines & centered dot	yes	solid state	5×9×4	3½	line or battery	189.95 a.c. 169.95 batt.
yes 14	yes	no	yes	none	yes	solid state	2⅞×8⅞×8⅜	3	line	134.95
yes 13	yes	yes	yes	chroma white, clear raster	no	solid state	8½×5¾×6⅜	4	line	169.00
yes 15	yes	no	yes	shading bars	no	tubes	8½×13×7	10	line	64.95 kit
yes 15	yes	no	yes	none	no	tubes	7½×16¾×18⅜	34	line	549.50
yes 15	yes	no	yes	"	no	tubes	5¼×10½×10½	15	line	245.00
yes 15	yes	no	yes	"	no	tubes	11 1/16×15×8⅛	20	line	359.50
yes 10	yes	no	no	"	yes	tubes	8½×11×5⅜	8	line	159.95
yes 18	yes	no	yes	"	yes	solid state	10⅜×10¾×5	6¼	line	159.50
yes 15	yes	yes	yes	clear raster	yes	solid state	7⅛×10⅝×5½	5	line	149.95
yes 13	yes	yes	yes	none	yes	solid state	3½×7⅝×9	5½	line	99.50
yes 13	yes	yes	yes	built-in vectorscope	yes	solid state	7½×8¼×12⅞	13	line	189.50
yes 14	yes	yes	yes	chroma raster	yes	solid state	6¼×10×4½	4¼	line	99.95
yes 14	yes	no	yes	clear raster shading bars	yes	solid state	3½×9½×10	5	line	124.95
no	yes	no	yes	none	yes	tubes	10×13½×8	13¼	line	189.50
yes 10	yes	yes	yes	clear raster	yes	solid state	3½×10½×8½	6	line	129.50
yes 6	yes	yes	yes	none	no	tubes	6¼×11⅛×6⅛	10	line	99.95
yes 6 & 18	yes	yes	yes	unkeyed rainbow gray raster	yes	tubes	6¾×13⅛×6⅛	10	line	129.50
yes 14	yes	yes	yes	none	yes	solid state	3×10½×8½	5½	battery	89.95
yes 14	yes	yes	yes	"	yes	solid state	3×10½×8½	5½	line	109.50
yes 14	yes	yes	yes	"	yes	tubes	9½×14×7⅜	15	line	187.50
yes 14	yes	yes	yes	"	no	tubes	9×11×6	10	line	109.95
yes 14	yes	yes	yes	"	yes	solid state	9½×10¼×4	8	line	149.95

Unique features and functions not found on other generators are incorporated in Amphenol's Model 860 (above, left) with its single dot and line patterns, Lectrotech's Model V7 (left) which has a built-in vectorscope, and B&K's Model 1076 (above) which has the ability to scan monochrome transparent slides to produce an unlimited number of patterns on the picture tube in the TV set under test.

assortment of models and features to choose from, what you select depends largely on the features you deem to be most important to you. However, don't be too hasty; just because a generator is not equipped with a gun killer, don't reject it. You can assemble a gun killer for less than 98 cents. But, there are other important features and equipment characteristics to look for, which don't show up as additional knobs, switches, and more test patterns.

For example, it is better to have one good stable crosshatch pattern than two other test patterns that are jumping all over the place. Stability and accuracy of signal are two very important generator characteristics. Battery life, portability, and price may also affect your choice of instrument. The "Guide to TV Color Bar Generators" should help you get a quick overview of what instruments are available and some of their features.

R.F., Video and Audio Signals. For convergence adjustments, the test patterns can be fed into the set at almost any point from the CRT back to the antenna terminals. But for convenience and for a check of overall set operation as well as for convergence adjustments, the signal is fed into the antenna terminals. Just about all of the generators provide a signal for Channels 3 and 4 to let you use a channel that does not have an on-the-air signal. Except perhaps for checking out the operation of the tuner, it isn't necessary to have an all-channel capability.

A video signal output is desirable for troubleshooting purposes and lets you inject a signal directly into the video amplifier stages to isolate or bypass front end, i.f., and detector troubles. Both the amplitude and polarity of this video signal should be controllable. In order to bypass the r.f. and i.f. sections of a color TV set that has separate sync and video detectors, separate sync and video signals of the correct phase and amplitude are needed.

Audio carrier signals facilitate adjustment of the TV set's fine tuning control. Proper setting of this control is critical for good color reproduction. Some generator instruction manuals advise adjusting the fine tuner control until the vertical and horizontal bars in the crosshatch pattern are of equal intensity. The audio signal, per se, is highly desirable, but it is not essential to the adjustment of any of the chroma or convergence circuits.

(*Continued on page* 96)

SCIENTISTS ARE TRYING TO TIE THOUGHT TRANSFERENCE, ESP, PRECOGNITION AND POLTERGEISTS TO RADIO WAVES

Biological Radio—ESP

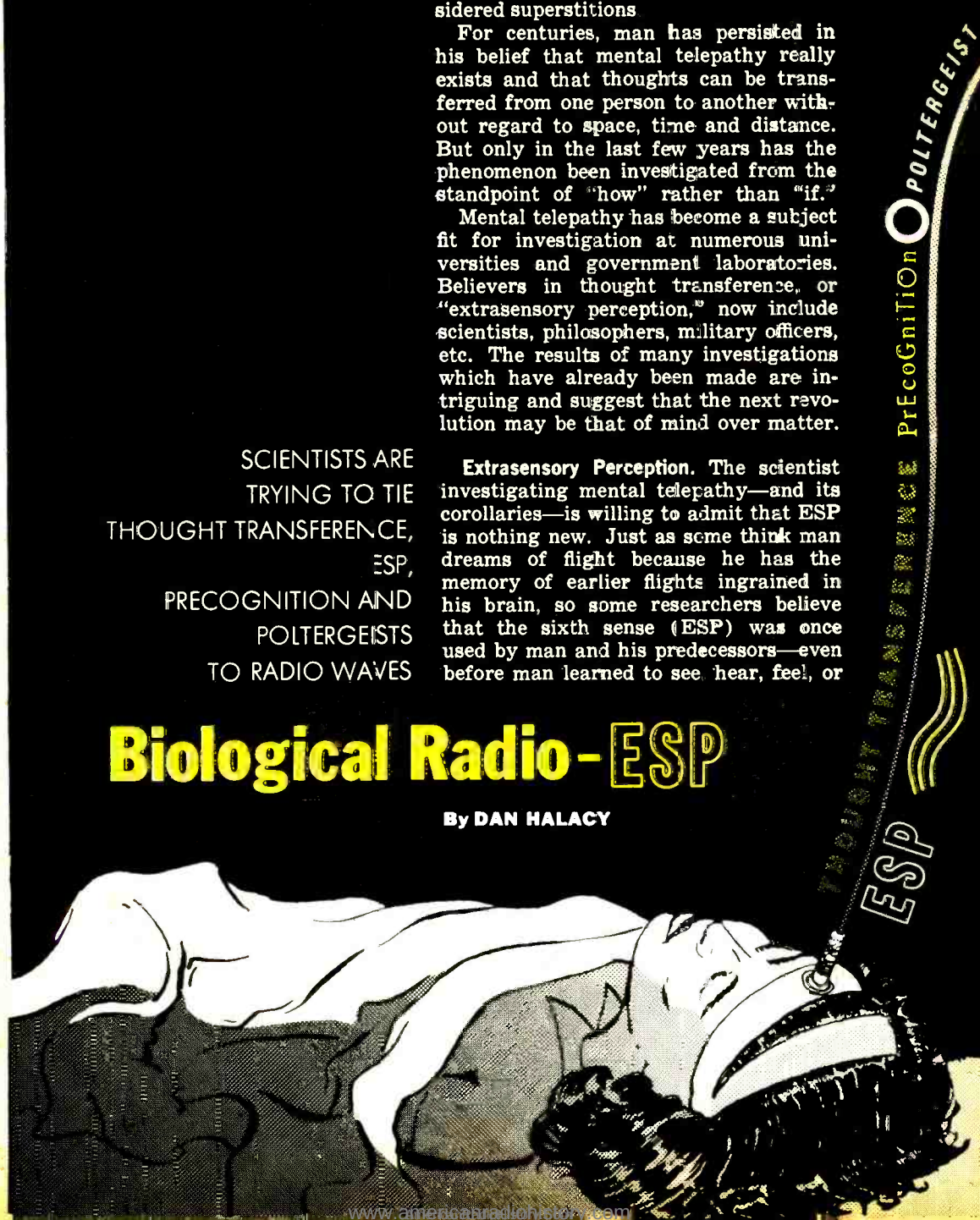
By DAN HALACY

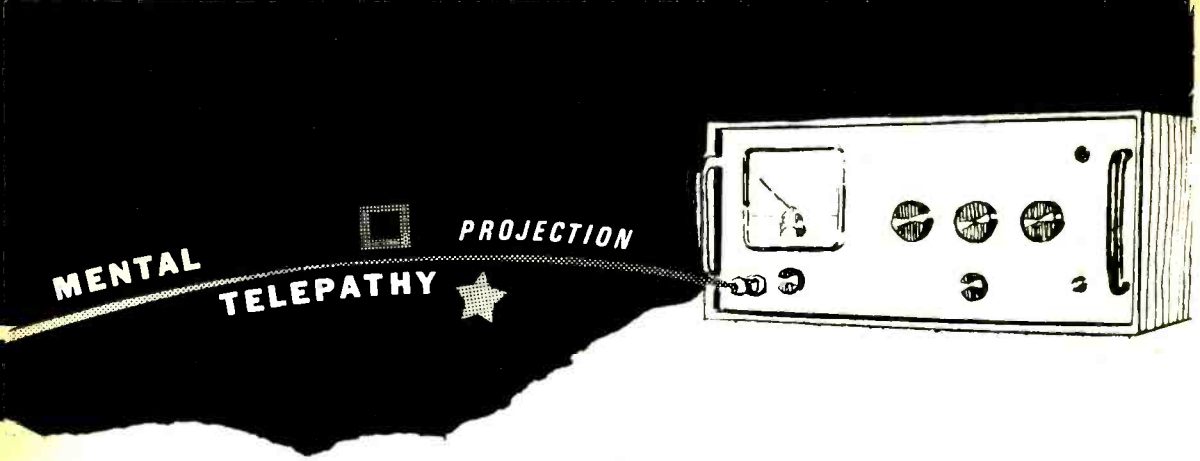
DO YOU believe in ESP or mental telepathy? Have you ever read the mind of another person, or received a "message" from a distant friend or relative? There's no need to feel embarrassed or apologetic about it, for ESP and thought transference—another name for mental telepathy—are no longer considered superstitions.

For centuries, man has persisted in his belief that mental telepathy really exists and that thoughts can be transferred from one person to another without regard to space, time and distance. But only in the last few years has the phenomenon been investigated from the standpoint of "how" rather than "if."

Mental telepathy has become a subject fit for investigation at numerous universities and government laboratories. Believers in thought transference, or "extrasensory perception," now include scientists, philosophers, military officers, etc. The results of many investigations which have already been made are intriguing and suggest that the next revolution may be that of mind over matter.

Extrasensory Perception. The scientist investigating mental telepathy—and its corollaries—is willing to admit that ESP is nothing new. Just as some think man dreams of flight because he has the memory of earlier flights ingrained in his brain, so some researchers believe that the sixth sense (ESP) was once used by man and his predecessors—even before man learned to see, hear, feel, or





talk. Proof of this thesis remains to be found, but it is certain that the notion of a sixth sense accomplishing all sorts of "magic" is as old as man's memory.

The recorded history of man is spotted with accounts of strange, unexplainable happenings involving thought transference, precognition, ghosts, poltergeists, levitation, miracles, etc. Even the most enthusiastic proponents of psychic phenomena admit that many of these reported happenings are probably imagined, exaggerated, or explainable. Even today, it is obvious that our more intelligent population is superstitiously swayed to report many things that just don't happen.

For example, an organization in New York City whose purpose is to investigate ESP claims to have checked into 1620 cases sent them after an appeal in a newspaper story. Of these, the organization dismissed more than 200 as "definitely screwball." Almost another 1000 were determined to be explainable in logical fashion and 350 others were so poorly documented as to be useless. The remaining 80 were followed up in detail, and only 20 of these appeared to be authentic cases of psychic phenomena.

Two organizations have been investigating ESP for three-quarters of a century. In 1882, the Society for Psychical Research was formed in England and has continued to function to the present date. In 1884, a similar society, the American Society for Psychical Research was organized. The investigations of these two organizations have provided some firm foundations for today's research activities. Among the more interesting results of these earlier investigations was the establishment of the fact that the American Indian had a name for ESP—*chumfo*. And the Australian aborigines have straightfacedly reported to anthropologists that they used smoke signals simply to attract the attention of a distant party and then communicated, or projected their message, through thought transference. This ties in with the idea of latent telepathic abilities still available to less sophisticated peoples.

Among the well-known and famous people who have at one time or another investigated ESP were men like W. H. Pickering, the famous astronomer; Houdini, the magician; scientist William Crookes; psychologist C. G. Jung; Elizabeth Barrett Browning; Rudyard Kipling; Aldous Huxley; and others.

More recently, Dr. J. B. Rhine at Duke University has become famous for his work in the field of ESP. His tests, conducted over decades and with thousands of subjects, are believed by him and his supporters to definitely show that ESP really exists. Many scientists remain unconvinced of the validity of Dr. Rhine's experiments, but the importance of his work and those of researchers in England has moved ESP from the realm of "spontaneous" manifestations of psychic powers to experimental demonstrations.

Biological Radio. Advanced electronics has made possible the scientific investigation of the generation and use of electricity in the bodies of animals and men. The fact that all living things generate electricity was known 2000 years ago, but knowing it and making intelligent use of that knowledge are two different matters.

The fact that electricity and life are

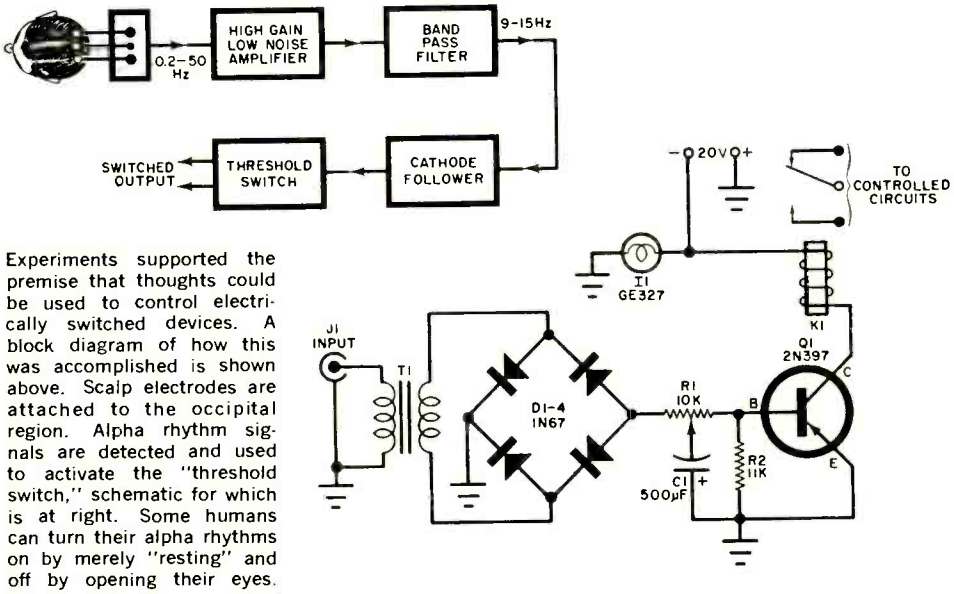
"...tests, conducted over decades... definitely show that ESP really exists..."

closely tied together should come as no surprise. All human and plant life depends on light, and were it not for the sun, we wouldn't be here—at least not in our present form. The sun broadcasts a shower of electromagnetic waves some of which are intercepted by the earth. Electricity and radio waves belong to this electromagnetic family. Many of the life processes of animals and other living things depend upon the flow of electrons, and it has been established that our brains generate tiny electric currents—as do our muscles and nerves. Communications within our bodies is to a large extent electric, or at least electrochemical.

We are aware that ionized air will affect the well-being of humans. It is known that some fish navigate by means of self-generated electric fields and use this field to detect obstacles in their paths. It is suspected that birds and animals may navigate by sensing deviation in the magnetic field of the earth.

A research team of scientists has made a study which seems to indicate that a correlation exists between changes in the earth's geomagnetic field and the occurrence of psychological disturbances in humans. These scientists believe that a flow of direct current electricity found in some animals is a holdover from Mother Nature's first "guidance system." Far from being modern and up to the minute, electronic communications and navigation systems are possibly a belated copying by man of what nature endowed him with but which has slowly been "forgotten."

The same researchers also believe that the fundamental control of our nervous system is carried out by organic "semiconductors," living electronic devices that will revolutionize the electronics art. If that sounds fantastic, consider the fact that it has been established that the brain generates both AM and FM



Experiments supported the premise that thoughts could be used to control electrically switched devices. A block diagram of how this was accomplished is shown above. Scalp electrodes are attached to the occipital region. Alpha rhythm signals are detected and used to activate the "threshold switch," schematic for which is at right. Some humans can turn their alpha rhythms on by merely "resting" and off by opening their eyes.

"...it is possible to assume that the same brain waves

signals. As recently as 1960, scientists reported that the human muscles have been found to generate "myoelectric" signals in the high frequency radio range.

Thought Transmission. In 1960, Walter Volkens and William Candib, an electronics scientist and a medical doctor, respectively, suggested that possibly humans may be able to consciously generate high frequency radio pulses—and that there may be living tissue receptors in human beings which can receive and interpret such radio waves. Four years later, a U. S. Air Force scientist, Dr. Edward Dewan, announced that he had trained human volunteer subjects to consciously alter the pattern of their brain waves.

Singling out the low-frequency "alpha rhythm" brain wave, Dr. Dewan related it to visual perception. Test subjects were able to control alpha rhythm brain waves to such an extent that, with the proper electronic accessories, they could use their brain waves to actuate a simple "off-on" switch. Thus, it is possible to assume that the same brain waves could be used to send a message in "binary code."

In the first experimental setup, the developer of the alpha rhythm communications method attached electroencephalograph electrodes to his own scalp in the occipital region. Not only could the alpha rhythms be used to turn on and off a small lamp (through special circuitry), but later trials with the lamp replaced by an audio oscillator showed that the developer could send two or three Morse code letters per minute.

While such a communications method hardly seems likely to replace those we have at hand, interesting possibilities exist. For instance, there are two regions of the brain, and perhaps the signals from both might be used. This would double the effectiveness of the alpha wave signals. Furthermore, it might be possible to learn how to modulate, or vary the frequency—rather than the amplitude—of the alpha rhythm, a somewhat crude parallel to FM radio transmission.

We should not forget that scientists have succeeded in powering tiny radio transmitters with the electricity from the bodies of rats. Electrical measuring devices implanted in patients or attached to their bodies can produce signals that might be transmitted over telephone wires or even by radio to a central medical facility for diagnosis. The next logical step is treatment by radio; the sending of radio control signals to an implanted receiver. This process is known as ESB, for electronic stimulation of the brain.

Research work at Yale University on ESB has been sponsored in part by the U. S. Navy's Office of Naval Research. The U. S. Air Force is also interested in ESB, and for several years comprehensive tests have been conducted at the Air Force's Cambridge Research Center to investigate ESP and ESB.

Electrophonic Hearing. Normally, most human beings hear with their ears sound waves transmitted through the atmosphere at a speed of something like 750 miles an hour. However, as long as two centuries ago, reputable men of science recorded occurrences where groups of people instantaneously heard sounds that were generated 50 miles away! Observers of the great meteor that flashed through the skies over Great Britain in 1783 heard a sharp hissing sound even as they watched the fireball.

Obviously, it is impossible to hear a sound that occurs 50 miles away before the passage of several minutes, but the observations of hundreds of listeners could scarcely be doubted and some kind of explanation was needed. Scientists have found it in what they call "brontophonic" sound.

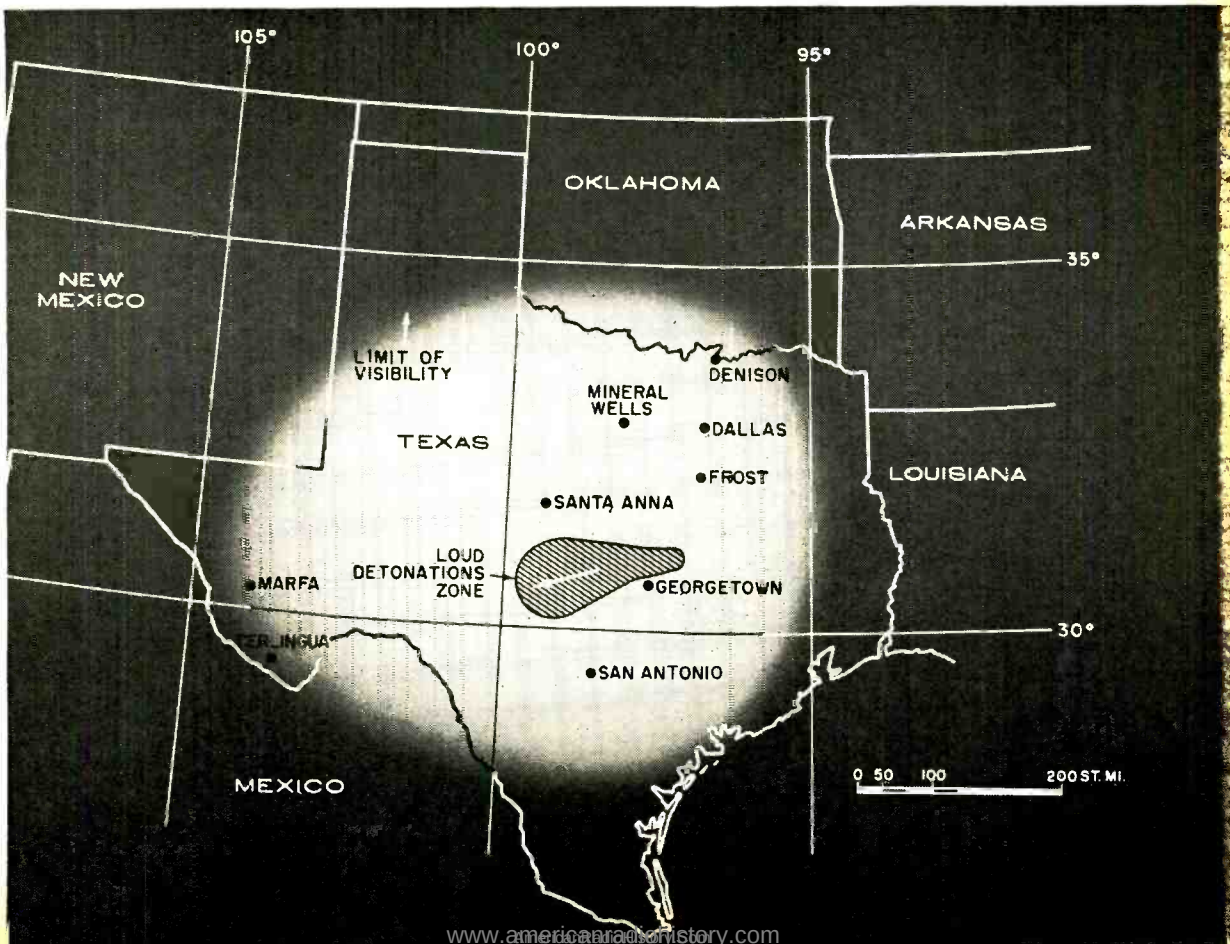
As a meteor flashes through the sky,

could be used to send messages in binary code . . . "

there is a sudden transformation of energy, some of which is manifested in electromagnetic disturbances. The sudden flash of light is an electromagnetic radiation, and the existence of this light indicates the possibility that other frequencies above and below the visible light spectrum are being radiated. Brontophonic sound appears to be sound generated in the listener's vicinity by objects that act as radio receivers and convert an unknown spectrum of radio fre-

ANOMALOUS SOUNDS AND FIREBALL METEORS

Hissing sounds and strange electromagnetic effects have long been associated with very bright meteors or fireballs. Some observers have described a swishing or crackling sound heard simultaneously with the passage of the meteor. Since these people are usually many miles away from the meteor, the sound-producing effect must be transmitted at the speed of light. Unfortunately, the scientific literature does not reveal the nature of the mechanism that could be associated both with hissing sounds at ground level and the passage of a meteor 100-200 miles away. In addition to sounds, many other observers have reported smells or sudden eerie sensations that defy rational explanation. A case in point is the well-documented fireball meteor that fell in Texas on October 1, 1917, at 10:30 p.m. People in all of the cities noted on the map below reported hearing swishing, buzzing, hissing, or whirring sounds. Observers in Grandview and Cleburne reported the sensation of heat, while those in San Antonio and La Grange also reported the smell of sulphur. The meteor path is shown by the white arrow. Two to five loud detonations were heard in the region indicated by the shaded area in the map.



"...serious research work is being done in Moscow..."

quencies into sound waves. The objects doing the converting could be plants, buildings, and the like, or they could be the listener's brain.

The leader strokes of lightning also generate brontophonic sound, as does the aurora borealis. These two natural phenomena obviously involve electromagnetic disturbances, although some scientists firmly believe that the lightning and aurora do not produce the same audible sound as that associated with meteorites. These investigators hold that the radio waves emitted by the meteor fireball may not produce sound waves at all, but are simply received by the brain and interpreted as sound! Such an idea was suggested back in 1930 by meteor expert H. H. Nininger.

The Brain As a Radio Receiver. In 1939, two investigators (S. S. Stevens and Hallowell Davis) reported on an experiment in which a 100-kHz signal modulated by a 400-Hz tone was passed through the head of a human being. The subject "heard" the 400-Hz tone signal, and the investigators suggested the possibility that a mechanism in the brain or ear was somehow rectifying the radio signal.

In 1961, A. H. Frey, working at the General Electric Advanced Electronics Center at Cornell University, demonstrated that his subjects could indeed "hear" r.f. transmissions. At a frequency of 1310 MHz, the subjects could detect these waves as recognizable sounds when the power density exceeded 400 microwatts per square centimeter. This was accomplished against a background noise of 90 dB. (In theory, according to Frey, as little as three microwatts could be detected as sound in an anechoic chamber.) The subjects reported that the UHF transmissions produced a hissing noise, but on occasion became a ticking, buzzing, or knocking, depending upon the characteristics of the transmission. This would seem to indicate that tiny amounts of power in sharply defined radio frequency beams could convey information to the human brain with no immediate conversion steps.

Work by other researchers in the field of electrophonic hearing has turned up evidence of electrostatic and magnetic fields surrounding the neurons in the human body. Presumably, the r.f. electromagnetic field might well interact with the neurons directly, to produce in the brain the same sort of perception as sound waves heard and transduced by the ear mechanism. Other research work has suggested that the synapses, or interconnections between neurons, may act as diodes—furthering the electronic computer analogy of the human brain. Perhaps the cerebral cortex, rather than the ear itself, functions as the radio receiver.

Radio ESP. Scientists behind the Iron Curtain refer to ESP by another name: "Biological Radio Communications." Their work is highly secret and conducted in carefully guarded laboratories. However, Russian observers have learned enough to realize that serious research work is being done in Moscow, Leningrad, and Omsk. Further, they have learned that the Russians are convinced that ESP is actually a form of electromagnetic radiation.

Apparently, such radio ESP is of a far more complicated nature than had been supposed by researchers in this country. For example, the Russians say that ESP signals are not carried on just one frequency, but on a series of frequencies scattered throughout the centimeter, millimeter, and micron bands. Substantiation of the Russian theory was reflected by Dr. Henry K. Puharich, who has drawn a number of parallels between psychical research and the information and communications sciences.

According to Puharich, who is president of a firm called Intelectron Corporation, the five senses commonly thought of as making up our contact with the

(*Continued on page* 120)

By A. J. LOWE

SOUND-FIRED STROBE STOPS MOTION FOR SHUTTERBUGS

CAPTURING an explosion at the instant of detonation is not new to photographers, but only a few well-endowed amateurs and professionals are equipped with a "motion freezer." However, if you have a camera, a strobe, and a tape recorder or other microphone-amplifier setup, you can add a "Sound Sync'er" to put you on the business end of stop-action photographs. There are only four electronic components in this gadget which should cost less than a sawbuck.

Actually the stop-action effect is made possible by the strobe flashgun, but the trick is to fire the gun at exactly the right time. When a sound burst accompanies and coincides with the action you want to photograph, the "Sound Sync'er" "listens" to the sound and "triggers" the flashgun. Use of an open-shutter technique in a "darkened" room lets you get by with a minimum amount of photographic equipment.

How It Works. The input of the "Sound Sync'er" is connected to the amplifier in place of the speaker and the output of the gadget goes to your flashgun. A microphone, connected to the input of the amplifier, completes the system, as shown in Fig. 1.

When the desired sound pulse hits the microphone, the signal is amplified and passed on to the silicon-controlled rectifier (*SCR1*) as shown in Fig. 2. Resistor *R1* provides a suitable load for the amplifier, and *R2* acts as a gate current limiter for *SCR1*. Diode *D1* permits a "cleaner" gating action to take place by allowing only the positive pulses to hit the gate of the SCR.

The SCR acts like a thyratron tube . . . once it is fired (allowed to conduct) by an appropriate signal on the gate, it conducts until the positive voltage on the anode is dissipated or removed. It is important, therefore, that the SCR's

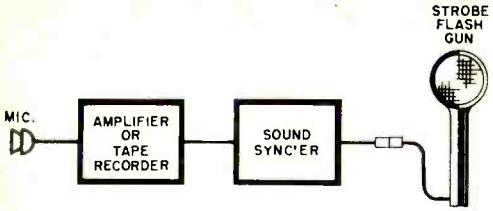


Fig. 1. Block diagram shows the setup required for using the sound from the action to be photographed to trigger the "Sound Sync'er" and strobe.

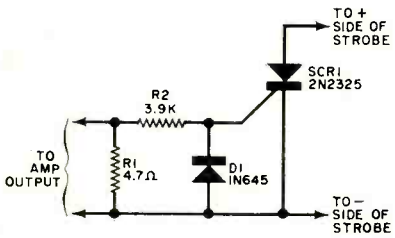


Fig. 2. Use the 2N2325 (available from Allied Electronics for $7.95) for silicon-controlled rectifier SCR1 and not the 2N2325A which costs $2 more.

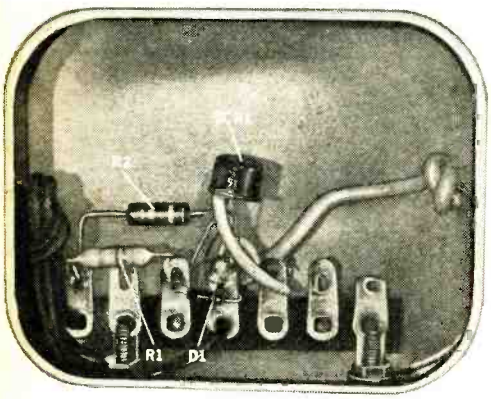


Fig. 3. The "Sound Sync'er" can be assembled on a terminal strip and mounted inside a small metal or plastic box. Use grommets to protect the cables.

anode be connected to the positive side of the strobe. The instant the SCR conducts, the strobe is fired.

Construction and Use. Layout is not critical, and you can save a lot of time by mounting the parts on a terminal strip as shown in Fig. 3. A small plastic or metal box can be used to house the parts. However, if you use a metal box, be sure to line the inside with insulating material to prevent accidental short circuits between the box and the strobe. Observe polarity of the diode as well as the SCR, and heat-sink the leads when soldering them in place.

Set up the microphone close to the object to be photographed, but not within camera view. Turn the volume control on the amplifier all the way down and slowly advance it until the amplifier will respond only to the desired sound signal. Too high a setting will trigger your strobe prematurely, and too low a setting will cause you to miss the shot. The speaker must be disconnected from the amplifier to prevent feedback howl.

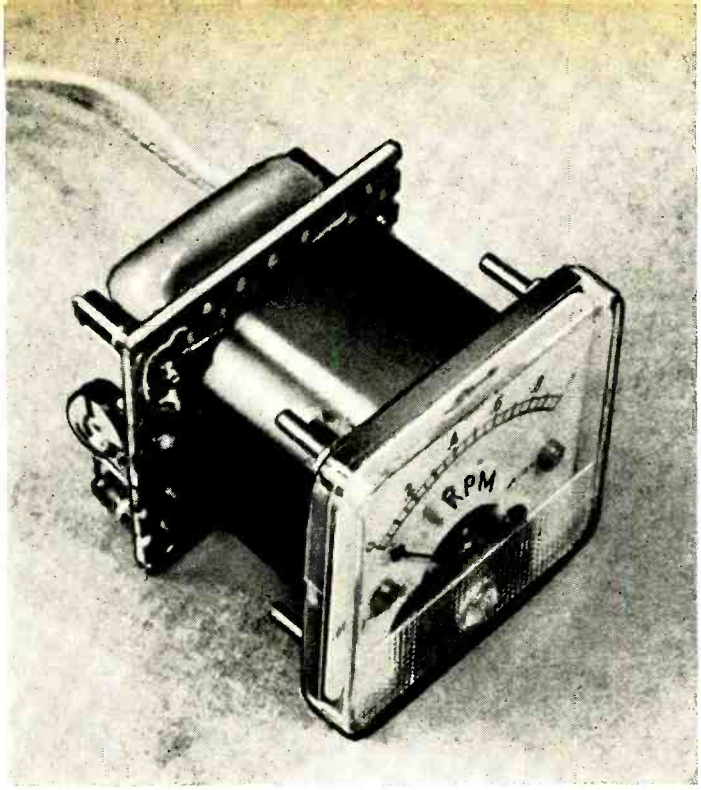
Fig. 4. For a professional finish, you can paint the case and apply suitable lettering to identify the input and output cables as shown.

PARTS LIST

D1—1N645 diode
R1—4.7-ohm, ½-watt resistor
R2—3900-ohm, ½-watt resistor
SCR1—2N2325 silicon-controlled rectifier, or similar
Misc.—Small metal or plastic box, terminal strip, wire, strobe extension cable, solder, hardware, etc.

By changing the distance between the microphone and the action being photographed, you can change the timing of the flash to capture the right "moment." Sound travels at about 1100 feet per second, so figure about a 1-millisecond delay for every foot separating the microphone and the sound source.

When you are ready to take a picture, set up your camera as you normally would for a flash shot, aim, focus, etc., and then turn off all the lights in the room, open the camera's shutter, and start the action. After the shot has been taken, close the shutter and turn the lights back on. —30—



BUILD

$6 ELECTRONIC TACHOMETER

TRANSISTORIZED CIRCUITRY KEEPS WATCH ON YOUR ENGINE SPEED FOR BETTER GAS MILEAGE, MAXIMUM EFFICIENCY, AND SMOOTHER PERFORMANCE

By RICHARD E. STAERZL

IF YOU DRIVE a manual shift auto, at what engine speeds—rather than road speeds—should you shift gear for top fuel economy with maximum horsepower and torque? At 65, 100, or 1800 r/min? The answer lies in the horsepower rating, number of cylinders, engine cycle, and other factors related to engine design.

Car makers' manuals usually contain information on specific engine r/min from idling speed through full acceleration, and specify when to shift gears, or when maximum torque is reached. However, if your car is not equipped with a tachometer, this information will be of little value to you.

For under six bucks you can build and install an accurate transistorized tachometer that can be used with any 4-, 6-, or 8-cylinder, 2- or 4-cycle engine having either a standard or transistorized negative-ground ignition system. This tach will tell you what your idling speed should be, when to up-shift for best acceleration and maximum efficiency, and when to down-shift to avoid engine lugging.

How It Works. The tachometer circuit (Fig. 1) is nothing more than a simple monostable multivibrator (*Q1* and *Q2*) triggered by a shaped positive-going rectangular pulse produced by the opening and closing of the auto's ignition

points. Pulse shaping is accomplished by the *C2-R6* combination.

The average current in *Q1*'s collector is monitored by a 0-1 mA full-scale meter. Since the collector current will be directly proportional to the trigger frequency, determined by the engine r/min, the meter can be calibrated in terms of r/min. The accuracy of the reading is determined essentially by the accuracy of the meter used. The economy meter shown is accurate within ±2% of full scale.

Construction. A convenient layout for the tachometer is given in Fig. 2. The parts are laid out on a 1½" x 1½" perforated phenolic board, and the circuit board is then mounted on the back of a d.c. milliammeter. Although an inexpensive 0-1 mA d.c. meter was selected to keep the cost low, a 3½"- or 4½"-wide view panel meter is preferable.

The entire unit can be housed in a plastic or metal case for use as a portable test instrument, or the meter case can be mounted separately on the dash while the electronic circuitry can be housed and stored in the glove compartment, or fastened under the dash.

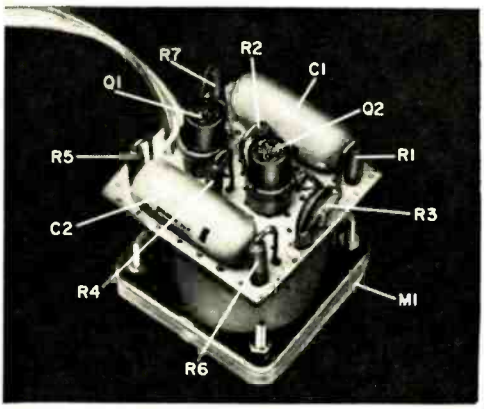


Fig. 2. The electronic circuitry is first put together on a suitable sized circuit board, and the assembly is mounted on the back of the meter case. You could also house the circuit board separately.

PARTS LIST

C1, C2—0.1-μF, 200-volt capacitor
M1—0-1 mA d.c. milliammeter—see text
Q1, Q2—2N414 transistor
R1, R2—2200-ohm, ½-watt resistor
R3—1000-ohm printed-circuit miniature potentiometer
R4—6800-ohm, ½-watt resistor
R5, R6—1000-ohm, ½-watt resistor
R7—120-ohm, ½-watt resistor
Misc.—Transistor sockets, phenolic circuit board, wire, solder, enclosure (optional)

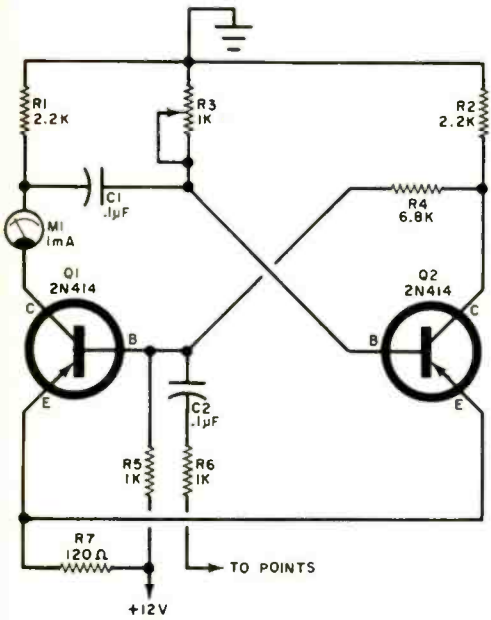


Fig. 1. This tachometer features the naked simplicity of a monostable multivibrator being triggered by the pulses generated by the ignition points.

Calibration. The easiest way to calibrate your tachometer is with another tachometer. Connect both tachs in parallel and rev the engine up to 1000 r/min. Then adjust *R3* for a reading of 0.1 mA on the meter being calibrated. With this adjustment, the meter is calibrated so that each 0.1 mA increment on the dial represents 1000 r/min. If you wish, you can also calibrate the meter directly in r/min.

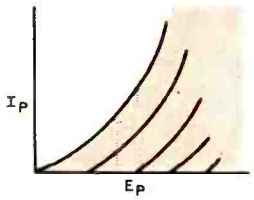
Another method of calibration is to use a high-output square-wave generator as a signal source. Set the generator frequency to 33 hertz for a 4-cylinder car, to 50 hertz for a 6-cylinder car, or to 67 hertz for an 8-cylinder car, and adjust the generator to any output from 6 to 24 volts peak-to-peak. Now adjust potentiometer *R3* until you get a reading of 0.1 mA on the meter. With this adjustment, your tach is calibrated for 1000 r/min per 0.1 mA. —30—

GRAPH INTERPRETATION QUIZ

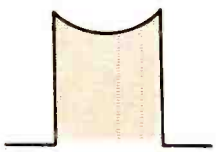
By ROBERT P. BALIN

Today's front-line electronic technician must be able to interpret readily the various charts and graphs devised by engineers to convey important information on the electrical characteristics of circuits as well as of individual components. In addition, the technician must be thoroughly familiar with the origin and composition of a variety of unusual as well as standard oscillographic waveforms. Test your ability to interpret the graphs and waveforms shown below (1-10) by selecting the most likely meaning, (A) or (B), from the two possibilities given in each case.

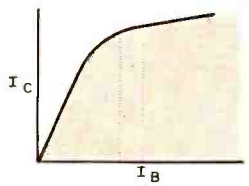
(*Answers appear on page* 107)



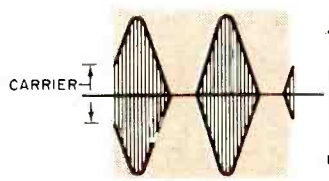
1 The family of plate characteristic curves for a triode shows that as the plate voltage is increased the a.c. plate resistance (A) increases or (B) decreases. _____



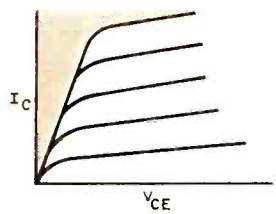
2 The distortion seen in this square-wave test signal indicates that the amplifier being tested is attenuating the (A) low frequencies or (B) high frequenices. _____



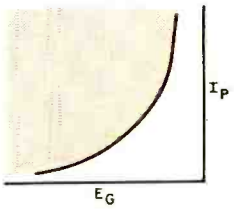
3 The collector current vs. base current curve for a transistor indicates that as the base current is increased the beta (gain) of the transistor (A) increases or (B) decreases. _____



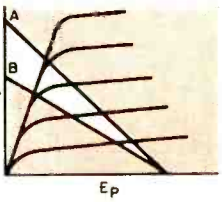
4 This transmitter modulation pattern indicates that the r.f. carrier is (A) overmodulated or (B) undermodulated. _____



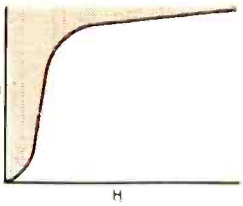
5 Output curves show that as a transistor's collector voltage increases, the a.c. output resistance (A) increases or (B) decreases. _____



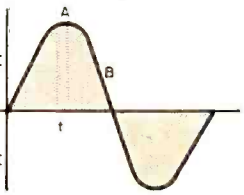
6 Vacuum-tube mutual transconductance curve indicates that as grid bias is increased mutual transconductance, Gm, (A) increases or (B) decreases. _____



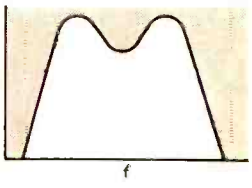
7 Of the two load lines, (A) and (B), shown in the graph at right, which one represents the larger value of load resistance? _____



8 The magnetization curve for a transformer core material shows that as the core goes into saturation its permeability (A) increases or (B) decreases. _____



9 The rate of change of a current depicted by a sine wave is greatest when the current is at its peak (A), or (B) when it is passing through 0. _____



10 This frequency response curve for a tuned transformer indicates that the windings are (A) overcoupled or (B) undercoupled. _____

How to get into

One of the hottest money-making fields in electronics today– servicing two-way radios!

HE'S FLYING HIGH. Before he got his CIE training and FCC License, Ed Dulaney's only professional skill was as a commercial pilot engaged in crop dusting. Today he has his own two-way radio company, with seven full-time employees. "I am much better off financially, and really enjoy my work," he says. Read here how you can break into this profitable field.

More than 5 million two-way transmitters have skyrocketed the demand for service men and field, system, and R&D engineers. Topnotch licensed experts can earn $12,000 a year or more. You can be your own boss, build your own company. And you don't need a college education to break in.

HOW WOULD YOU LIKE to start collecting your share of the big money being made in electronics today? To start earning $5 to $7 an hour... $200 to $300 a week... $10,000 to $15,000 a year?

Your best bet today, especially if you don't have a college education, is probably in the field of two-way radio.

Two-way radio is booming. Today there are more than *five million* two-way transmitters for police cars, fire department vehicles, taxis, trucks, boats, planes, etc. and Citizen's Band uses—and the number is still growing at the rate of 80,000 new transmitters per month.

This wildfire boom presents a solid gold opportunity for trained two-way radio service experts. Many of them are earning $5,000 to $10,000 a year *more* than the average radio-TV repair man.

Why You'll Earn Top Pay

One reason is that the United States Government doesn't permit anyone to service two-way radio systems unless he is *licensed* by the Federal Communications Commission. And there simply aren't enough licensed electronics experts to go around.

Another reason two-way radio men earn so much more than radio-TV service men is that they are needed more often and more desperately. A home radio or television set may need repair only once every year or two, and there's no real emergency when it does. But a two-way radio user must keep those transmitters operating at all times, and *must* have their frequency modulation and plate power input checked at regular intervals by licensed personnel to meet FCC requirements.

This means that the available licensed experts can "write their own ticket" when it comes to earnings. Some work by the hour and usually charge at least $5.00 per hour, $7.50 on evenings and Sundays, plus travel expenses. A more common arrangement is to be paid a monthly retainer fee by each customer. Although rates vary widely, this fixed charge might be $20 a month for the base station and $7.50 for each mobile station. A survey showed that one man can easily maintain at least 100 stations, averaging 15 base stations and 85 mobiles. This would add up to at least $12,000 a year.

Be Your Own Boss

There are other advantages too. You can become your own boss—work entirely by yourself or gradually build your own fully staffed service company. Instead of being chained to a workbench, machine, or desk all day, you'll move around, see lots of action, rub shoulders with important police and fire officials and business executives who depend on two-way radio for their daily operations. You may even be tapped for a big job working for one of the two-way radio manufacturers in field service, factory quality control, or laboratory research and development.

How To Get Started

How do you break into the ranks of the big-money earners in two-way radio? This is probably the best way:

1. Without quitting your present job, learn enough about electronics fundamentals to pass the Government FCC Exam and get your Commercial FCC License.
2. Then get a job in a two-way radio service shop and "learn the ropes" of the business.
3. As soon as you've earned a reputation as an expert, there are several ways you can go. You can move *out* and start signing up and servicing your own customers. You might become a franchised service representative of a big manufacturer and then start getting into two-way radio sales, where one sales contract might net you $5,000. Or you may even be invited to move *up* into a high-prestige salaried job with one of the major manufacturers either in the plant or out in the field.

THIS COULD BE YOUR "TICKET" TO A GOOD LIVING. You must have a Commercial FCC License to service two-way radios. Two out of three men who take the FCC exam flunk it... but nine out of ten CIE graduates pass it the first time they try!

The first step—mastering the fundamentals of Electronics in your spare time and getting your FCC License—can be easier than you think.

Cleveland Institute of Electronics has been successfully teaching electronics by mail for over thirty years. Right at home, in your spare time, you learn electronics step by step. Our AUTO-PROGRAMMED™ lessons and coaching by expert instructors make everything clear and easy, even for men who thought they were "poor learners." You'll learn not only the fundamentals that apply to all electronics design and servicing, but also the specific procedures for installing, troubleshooting, and maintaining two-way mobile equipment.

Get Your FCC License... or Your Money Back!

By the time you've finished your CIE course, you'll be able to pass the FCC License Exam with ease. Better than nine out of ten CIE-trained men pass the FCC Exam the first time they try, even though two out of three non-CIE men fail. This startling record of achievement makes possible the famous CIE warranty: you'll pass the FCC Exam upon completion of your course or your tuition will be refunded in full.

Ed Dulaney is an outstanding example of the success possible through CIE training. Before he studied with CIE, Dulaney was a crop duster. Today he owns the Dulaney Communications Service, with seven people working for him repairing and manufacturing two-way equipment. Says Dulaney: "I found the CIE training thorough and the lessons easy to understand. No question about it—the CIE course was the best investment I ever made."

Find out more about how to get ahead in all fields of electronics, including two-way radio. Mail the bound-in postpaid reply card for two FREE books, "How To Get A Commercial FCC License" and "How To Succeed In Electronics." If card has been removed, just send us your name and address on a postcard.

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НЕОБЫЧНАЯ ТЕЛЕВИЗИОННАЯ АНТЕННА

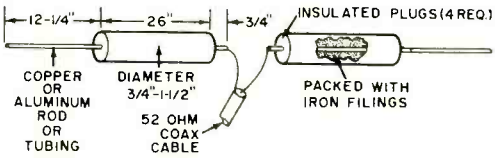
По письму, полученному редакцией из г. Воронежа от радиолюбителя Д. Абызова, была приложена заметка, напечатанная в газете «Молодой коммунар». Заметка называлась «Антенна-малютка». В ней описана примененная слесарем локомотивного депо в г. Георгиу-Дея В. Архиповым телевизионная антенна небольших размеров и необычной конструкции. Тов. Абызов высказывал сомнения, будет ли работать такая антенна и можно ли верить сообщению «Молодого коммунара».

Ответ на вопросы тов. Абызова содержался в другом письме, которое редакция получила от радиолюбителя И. Сокола (пос. Кленовый Ровеньковского района Луганск обл.). Тов. Сокол написал в редакцию, что антенна В. Архипова построена, и он хорошо и регуля принимает на нее программы т центров, находящихся в Луга (55 км, 4-й канал) и Ростове-на- (105 км, 1-й канал).

Для проверки письма тов. редакция командировала св трудника, который, возвра сообщил, что он вместе с т лы смотрел передачи обоих ров. Качество изображе вполне удовлетворительны

Что же это за антенна?

Как видно из рисунка, это диполь. На половины диполя, которые изготовляются из дюралюминиевой трубки или медного прута (у тов. Сокола, например, для полудиполей применен шахтный троллейный провод диаметром 6 мм), надеты трубки из изоляционного материала д метром 22÷40 мм. Тр стальными опилк торцов изолиру рез к Для 2,3



The dimensions shown for this TV antenna would be suitable to receive American Channel 6. From the meager information presented in the Soviet magazine, the iron filings might act as a crude ferrite.

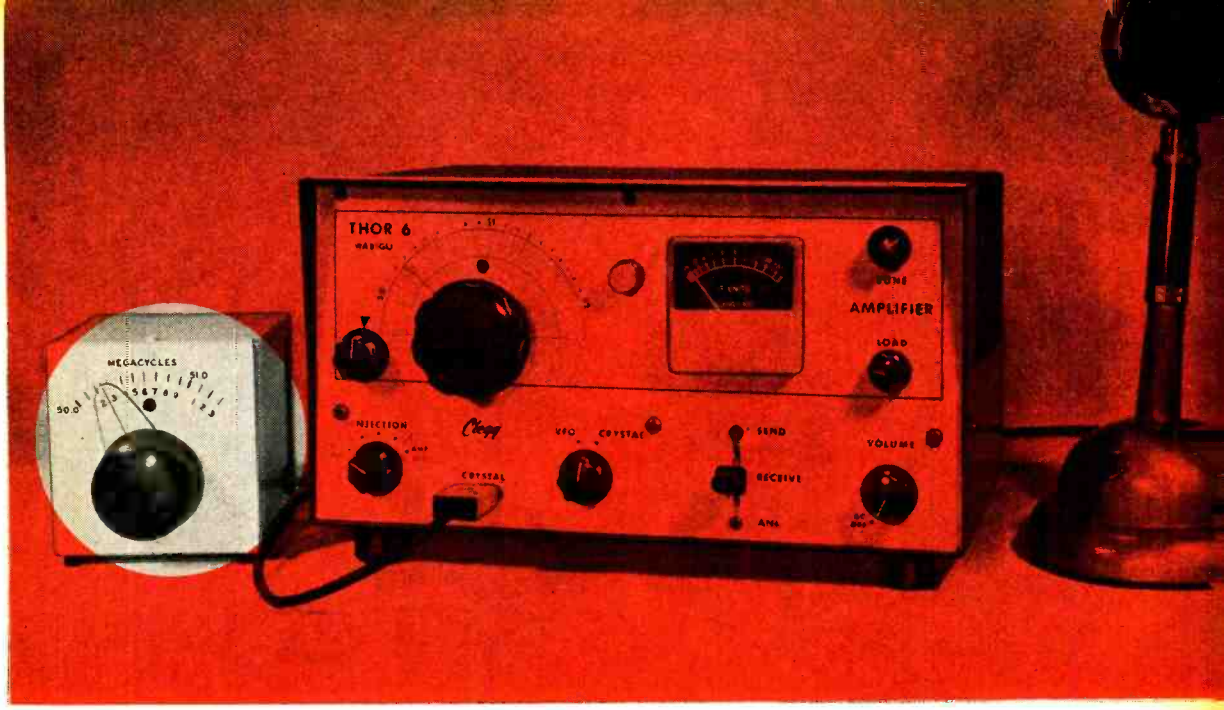
LITERALLY "AN UNUSUAL TV ANTENNA"

IF YOU ARE an inveterate experimenter and if you read Russian—especially the Soviet electronics hobbyist journal, *Radio*—the title of this article may stir a memory. The antenna described here was originally presented in the October, 1966, issue of *Radio* on page 56. The Editor of *Radio* stated that he had received a letter describing a "tiny antenna" constructed by a railroad worker which was reported to be faithfully capturing TV signals 35 and 65 miles from the worker's home.

At first glance, the strange antenna in the drawing above appears to be a simple dipole in shunt with a crude ferrite antenna. The dimensions given are for Soviet Channel 4 (84-92 MHz), and according to *Radio,* the dipole section may be ordinary copper or aluminum tubing. The large tube of insulated material can be $\frac{3}{4}$" to $1\frac{1}{2}$" in diameter. This larger tubing is filled with iron filings and plugged at each end with insulating washers. The length of the insulated tubing appears to be approximately two-thirds of the length of each dipole element. No dimensions were published in *Radio* for any other TV channels.

The impedance would appear to be between 50 and 70 ohms, since a coaxial cable is connected to the antenna. Further improvements could probably be made by introducing a balanced feed line and matching the antenna input to the feed line. Despite its exotic structure and the obvious skepticism of the Soviets, there are reports that this TV antenna works remarkably well.

—*Joseph Zelle*



BUILD

THE INCREDIBLE VFO

. . . A SIMPLE, PRACTICAL, INEXPENSIVE VFO THAT REALLY WORKS

By R. L. WINKLEPLECK, WA9IGU

IF YOU ARE A HAM, you know that the only substitute for an unlimited supply of transmitter crystals is a stable variable-frequency oscillator (VFO). But you also know that VFO's are sometimes unstable, and minute changes of coil dimensions due to heat produced from nearby vacuum tubes and resistors, or changes in the electrode voltages of the vacuum tube oscillator, *can* and *do* cause the drift.

You can build a relatively stable *passive* VFO using a couple of capacitors and an inductor—a VFO in which there are no tubes or resistors to heat up, and no power supply or transistors to contend with. You don't have to lay a finger on your transmitter circuitry, either. You simply put a few parts together in a metal box, remove the transmitter crystal, and plug the VFO right into the crystal socket.

Why isn't everybody using this incredible VFO? The reasons are simple. Hams tend to distrust passive circuits that appear to offer something for nothing and, furthermore, external passive VFO's don't work with all transmitters. The transmitter's oscillator must be capable of sustaining oscillation by itself. A passive VFO merely determines the frequency of oscillation and is not an oscillator circuit in itself.

When It Can Be Used. If your transmitter employs any variation of the basic grid-plate oscillator shown in Fig. 1, you're in! Observe that there's an r.f. choke in the cathode of the oscillator tube, and that the crystal is connected between grid and ground. Note also that a feedback path is provided from cathode to grid via a capacitance divider.

Other circuit variations, such as a resistor across the crystal socket or in the cathode lead, or a coupling capacitor in the grid circuit, are acceptable. For, once you remove the crystal and connect the "Incredible VFO" in its place, you will have a series-tuned Colpitts oscillator that will work like a charm in any frequency range permitted by the series L-C combination.

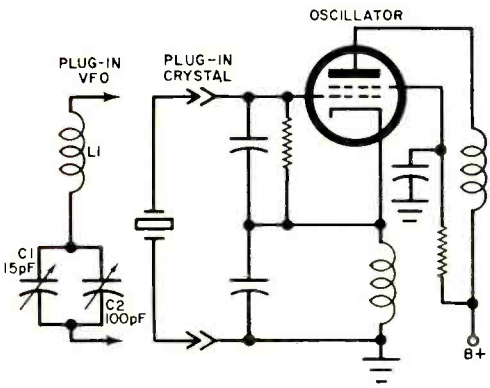


Fig. 1. To convert this crystal-controlled oscillator to a series-tuned Colpitts VFO, simply replace the crystal with the L-C combination shown.

Pro's And Con's. Before deciding on a passive VFO, consider all of it's features —good and bad. Obviously, it's cheap, simple, and easy to build. And as stated previously, it requires no tubes or transistors, and no power supply. If well built, and if the oscillator voltage is stable, it will exhibit very little drift. Differences in plate voltage will usually swing the frequency a bit, however. Use of the "Incredible VFO" does not require that you modify your rig, and it can be replaced with your original crystal at a moment's notice.

If your construction is sloppy, the unit's performance will be sloppy. To a degree, this VFO is susceptible to body capacitance, and you must not touch the connecting cable or plug while on the air or your frequency will shift. And if you place the VFO too close to the transmitter, temperature changes could produce a significant frequency drift.

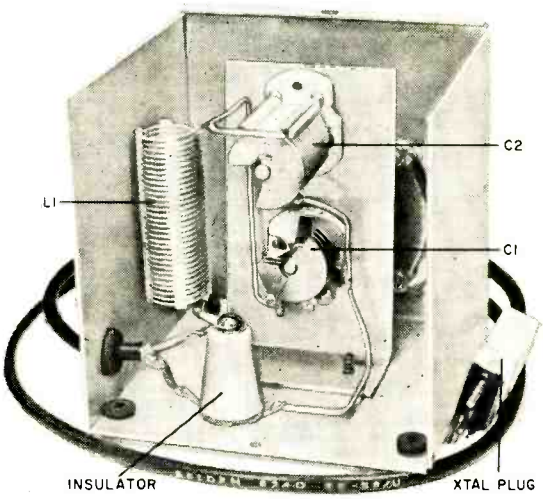


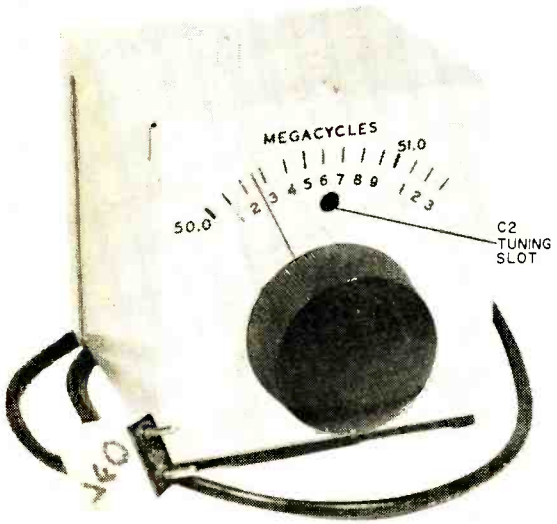
Fig. 2. The tuning capacitors are premounted on a heavy aluminum subpanel which is then secured to the base of the enclosure. The insulator floats the underground cable lead from coil to xtal plug.

Construction. You can build a passive VFO for any transmitter frequency you want. Appropriate inductance and capacitance values for frequencies in the amateur bands, from 1.75 to 220 MHz, are given in Chapter 2 of the *Radio Amateur's Handbook*.

If, for instance, you work on six meters and want to replace your 8-MHz crystal with a passive VFO, you will need a 2″

length of B&W Miniductor coil #3007 for *L1*. Unwind about half a turn from each end of the coil to serve as connecting leads. The coil length given does not include the leads.

Two capacitors in parallel cover the entire 2-MHz frequency band. The larger capacitor, *C2*, is variable to 100 pF and determines the tuning range of the band. It is screwdriver-adjusted through a hole in the front panel. The smaller capacitor, *C1*, is variable to 15 pF and



Alignment of the VFO is a simple matter, and requires no special test equipment. All you need is a receiver to monitor the VFO signal while you adjust capacitor C2 until the signal is heard.

tunes in the desired frequencies. It is equipped with a vernier dial for ease of calibration and tuning. The capacitors and the coil are connected as shown in Fig. 2.

Both capacitors should be of high quality and of rugged construction to insure frequency stability. They are both mounted on a heavy aluminum subpanel, and the entire assembly is housed in a 4" x 4" x 4" aluminum box.

Use heavy pieces of wire—No. 12 or larger—to join the capacitors together. Connect the coil between the high side of the capacitors and the top of a 1" porcelain insulator. Affix solder lugs at both extremes of the insulator before mounting.

Strip one end of a short piece of RG-58/U cable and solder the center conductor to the lug on the high side of the insulator along with the coil terminal. The shield strands of the cable go to the ground lug under the insulator, together with the common (ground) lead from the capacitors. Be sure there is a good ground to the chassis.

The coax cable is run through a grommeted hole in one side of the case, and the free end is terminated with a suitable crystal holder that will mate with your particular crystal socket. Be sure to mark the pin with the ground shield, as well as the grounded side of the crystal socket on your transmitter. Always connect ground to ground.

Alignment. The alignment of the VFO can be a little tricky, but if you proceed slowly and carefully, you should have no trouble at all. Plug the VFO into the crystal socket of your transmitter; then fire up the transmitter and allow it to warm up with plate voltage applied to the oscillator only.

Set the VFO's main tuning dial (*C1*) near its center of rotation. Turn on your receiver and set it to a frequency in the middle of the VFO's expected operating range. Through the access hole, tune *C2* —very slowly—until the receiver picks up the VFO signal. Alternately tune *C1* and *C2* for the strongest signal.

Put a dummy load across your transmitter's antenna output and set the transmitter to "transmit." If the transmitter loads properly, fine. If it does not, you are probably working on a frequency outside of the transmitter tuning range, and you must retune *C2* to operate in the correct frequency range.

After you find the point where the transmitter loads properly, and you can pick up the signal, mark the receiver-indicated frequency on the VFO dial as your first calibration point. Continue tuning the band, resetting *C1* to a different spot as you go along, and calibrating the VFO dial with the new frequency. Do not disturb the setting of *C2* after its initial adjustment.

If your transmitter exhibits an undue amount of drift, it is probably due to poor power supply regulation. You can correct this condition by adding the necessary circuitry to regulate your power supply. -30-

Getting The Most From Your CB Rig

AN IMPORTANT NOTE ON TUNING YOUR TRANSMITTER

By **DANIEL MEYER**, KMT2967

EVERY CB USER is entitled to get the maximum legally permitted power output from his transceiver. As long as the average input power is 5 watts or under, or the average output power is 4 watts or less, the FCC has no complaints. The most common methods of achieving optimum CB results, such as proper antenna matching, microphone techniques, etc., are well covered in the instruction manuals and have been detailed in many magazine articles. However, there is one subject on which much misinformation abounds yet is a vital point if you want to get maximum CB operating results within the legal limits. This is the matter of transmitter alignment.

Transmitter Alignment. Practically all of the instruction manuals supplied with CB equipment describe the transmitter final amplifier adjustments required in order to obtain maximum r.f. output. Usually these manuals recommend the use of a 52-ohm dummy load and adjustment of the final tank circuit for maximum meter reading (built-in metering, or power output metering). This method assumes that maximum r.f. output is the principal criterion in achieving best CB coverage. This might be true if the CB rig were being used for code transmissions, but it is completely wrong with voice modulated transmitters.

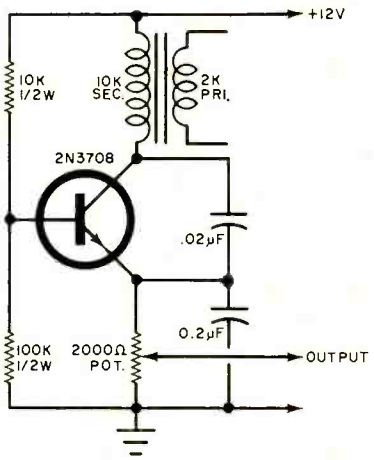


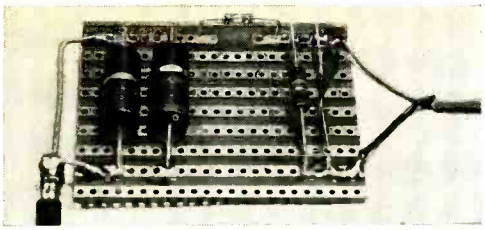
Fig. 1. This simple single-tone audio oscillator can be jury-rigged to provide a signal to modulate your CB rig. Tap the output to the hot side of the mike input. The transformer is a miniature component used for transistor interstage coupling.

Maximum CB coverage results when the received signal is demodulated at a distant point. Primarily, we are inter-

TRANSCEIVERS	METHOD OF ALIGNMENT			
	Tuned for Maximum RF		Tuned for Maximum Modulation	
	RF Output (W)	Det. Audio (V)	RF Output (W)	Det. Audio (V)
(1) Tube CB	3.75	3.5	3.5	4.0
(2) Transistor CB	3.5	3.25	3.25	3.8
(3) Tube CB	4.25*	2.0	3.0	4.0
(4) Transistor CB	3.25	3.0	3.0	3.5
(5) Tube CB	2.5	2.75	2.25	3.25

*Illegally modified.

Table 1. Here are the results of tuning up five different CB rigs for maximum detected modulation rather than maximum r.f. output. All five transceivers got out better after the "modulation" tuneup.



POPULAR ELECTRONICS lab-tested the author's method with results that proved "modulation" tune-up was best. This is a Veroboard (wiring side up) hookup assembled in 10 minutes. Coax input is to the left, leads to the scope or VTVM to the right.

ested in getting the maximum amount of demodulated audio power at the receiver. Obviously, to obtain this maximum demodulated audio, we should tune the transmitter for maximum modulation rather than maximum r.f. output.

The received signal level depends on the amount of audio detected and not on the amount of carrier present. Actually, the less r.f. power needed to accomplish the job, the better the received signal.* Manufacturers do not suggest transmitter alignment for maximum modulation because this requires test equipment and is not as simple as aligning for maximum r.f. output.

How It Is Done. To align your CB rig for maximum modulation, you need an audio oscillator. If you cannot borrow one, you can construct a very simple transistorized oscillator as shown in Fig. 1. The audio frequency is not critical and any frequency between 400-2000 hertz will do.

You will also need a dummy load-detector circuit similar to the one shown in Fig. 2. This circuit can be put into a small metal box or simply soldered together at the end of a short piece of coax cable. The output of your dummy load-detector circuit can be connected to an oscilloscope, a VTVM, or even a good multimeter.

The audio oscillator is connected to your microphone input. It is not necessary to disconnect the microphone; simply clip the output of the audio oscillator to the mike connector—or even to an input grid circuit under the chassis, whichever is handier.

*See "Mule Box," POPULAR ELECTRONICS, March 1967, page 45.

To align the transmitter, key the transmitter and adjust the output of the oscillator for a clean sine wave as displayed on your oscilloscope. Do not increase the output of the oscillator past the point where the waveform is clipped, flattened or distorted. If you're using a multimeter or VTVM, the distortion point can be determined as that point where no further increase in output is obtained as the oscillator level is increased. The output signal (with the circuit shown) will generally be on the order of 2-6 volts r.m.s. The exact voltage depends upon the diode and the meter loading but is not important in aligning the transmitter.

Watch the scope, or meter, and adjust the final amplifier tuning and loading for maximum output. Adjust the controls in much the same way as you adjust those designed to tune up for maximum r.f. output. However, you will find that in

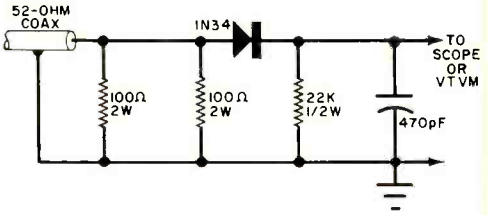


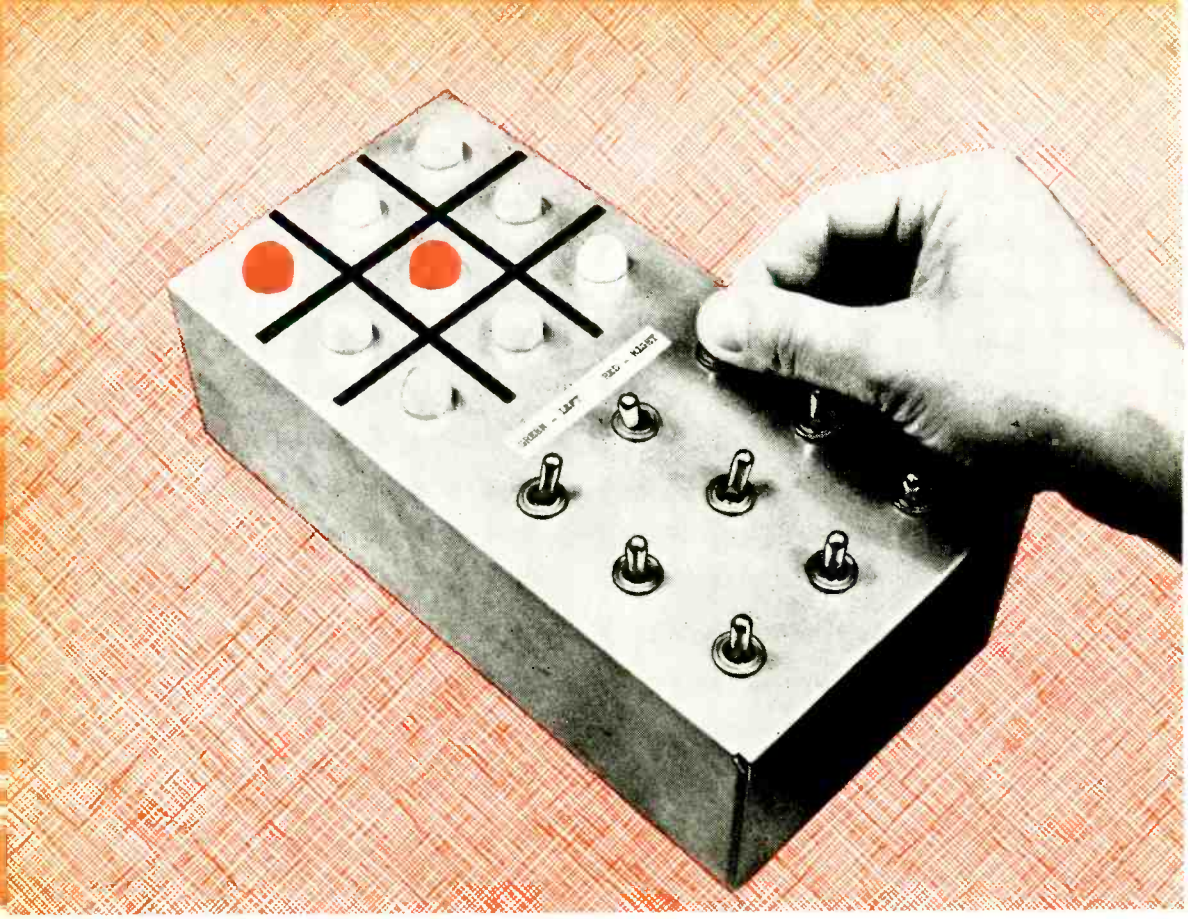
Fig. 2. To demodulate your CB output, you will need this circuit. Use a scope or VTVM to measure the output voltage—a VOM loads down the circuit.

tuning for maximum modulation the adjustments are much sharper and more critical. The two adjustments (in a usual pi-network) will interact.

It is recommended that you align your CB rig using an oscilloscope. The scope will also show if your rig produces distortion, which would result in reduced intelligibility and waste power output in audio harmonics.

Results. How much you can expect to gain by this method of alignment will depend on the particular CB rig you are using. Several examples of CB rigs aligned by the author are included in Table 1. In some cases, the alignment made for maximum r.f. output happened to result in something near the correct setting for maximum modulation. In oth-

(*Continued on page* 102)



BUILD THE ELECTRIC TIC TAC TOE

PERMANENT GAME SETUP IS EYE-ATTRACTIVE SCIENCE FAIR PROJECT

YOU CAN BUILD this tic-tac-toe game with a minimum of parts. The novel feature of the game is that each one of the 9 translucent indicators lights up red or green according to the play. The secret of the design is the use of miniature grain-of-wheat bulbs.

The game shown in the photo was built by the author in a 3" x 10" x 5" aluminum chassis fitted with a bottom plate. If you duplicate the author's model, draw (with a pencil) two sets of 1½" tic-tac-toe squares on the top surface of the chassis. In the center of each of the bottom 9 squares mount a single-pole, double-throw, center-off toggle switch so that the handle moves from side to side.

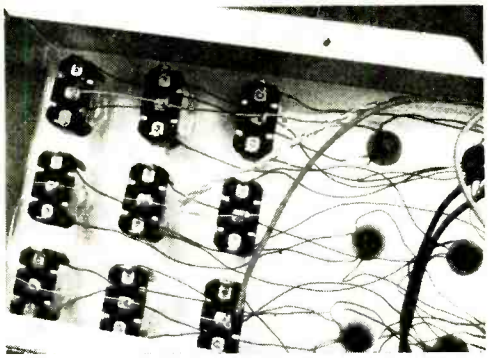
In the center of each of the top 9 squares, drill a ½" hole. Carefully enlarge each hole with a file or reamer so that the plastic lens cap of each of the Dialco lamps can be pushed/twisted into place. The 12-volt red and green grain-of-wheat bulbs are sold by most hobby

shops. Each bulb will cost about 15¢. The leads should be sufficiently long to permit wiring the red and green bulbs directly to the toggle switches as shown in the schematic diagram. Handle the bulbs with care, since they break easily. As each pair of bulbs (one red, one green) is wired to its switch, position them in the lens cap. Cement the bulbs in place with a clear plastic cement, or tape them in place with Scotch or plastic adhesive tape. Also, tape the leads down to the chassis as they go from lens cap to switch.

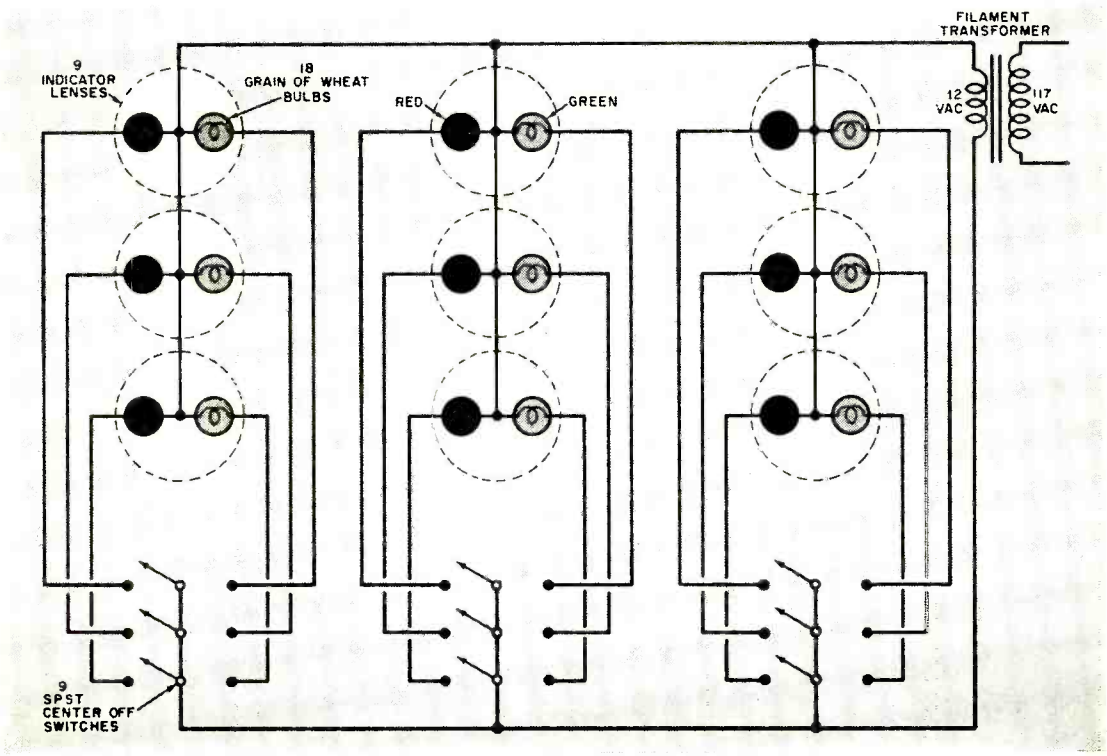
Finally, mount the power transformer on the chassis wall and install a terminal strip under each of the mounting screws to serve as convenient tie points for the 18 common bulb leads which are connected to the transformer.

Erase your pencil lines and paint in heavier black lines to represent each tic-tac-toe square. Lettering or press-down labels to indicate switch positions will simplify operation for the players. The red and green lights are used in place of the usual "X" and "O".

—*Ken Greenberg*



Generally speaking, the leads from most grain-of-wheat lamps will be long enough to be wired directly to the switches. These leads are fragile, so treat them with care. The white Dialco lens cap is known as the manufacturer's part number 95-935. Not all catalogs carry this item, but the larger radio parts jobbers will have these plastic replacement lenses in stock.



INFORMATION CENTRAL

By CHARLES J. SCHAUERS, W6QLV

THANK YOU for your many letters and postcards and your favorable reaction to the first two *Information Central* columns appearing in the February and March issues. A considerable number of interesting questions have been received, and if the flow continues undiminished, the Editor-in-Chief may increase the space allocation of this column.

The questions selected for publication in this month's installment of *Information Central* represent a broad sampling of the varied activities of our readers. Keep the questions coming!

Severe Ignition Noise. *I use CB in my small trucks and the ignition noise is driving my drivers crazy. None of the usual prevention methods (shielding, filtering, etc.) provide any relief.*

When ignition noise gets that bad, the only practical way to obtain decent reception is to eliminate the ignition pulses in the i.f. stages—not in the audio. While no one I know has air-tested every CB transceiver, the POPULAR ELECTRONICS editors have found that the Squires-Sanders "23'er" and Lafayette "CB Commander" (HB-600) both have i.f. noise silencing and are tops in ignition noise elimination. The effectiveness of most noise limiters of the audio type vary according to the circuitry and there's no way of predicting if one CB transceiver will surpass another—except those with i.f. noise silencing or quieting.

Commercial Kit Manuals, Again. *Your March column told about out-of-date manuals and diagrams from Allied (Knight-Kit) and Heath, but what about EICO?*

Sorry, but EICO did not respond to my request for information until the March deadline had passed. However, Henry Berlin, EICO's Marketing Administrator, says that most diagrams are available and many old manuals are in stock.

Transistor Substitution Handbook. *Where can I find details on all the transistors made throughout the world and some data on logical substitutions?*

Your best bet here is to obtain the 1967 edition of the "Transistor Specifications and Substitution Handbook" published by Tech-Press, Inc., Brownsburg, Indiana 46112. This handbook is catalog number TSSH-3 and sells for $2.95. The 1967 edition of this handbook lists over 6000 transistors and details all of their specifications. In addition, it has a separate section on substitutions.

CB Crystals. *A friend tells me that all CB crystals are the same and that he and I can swap crystals even though his transceiver has tubes and mine is all transistors. Is he right?*

Absolutely not. Every CB transceiver that I know about uses a special brand of crystal and substituting a crystal not specifically made for your transceiver may put you off-frequency. The FCC reports that off-frequency operation by CB'ers is one of the most common violations. Sometimes swapped crystals will work, but more often you are likely to find your frequency 1-3 kHz off the channel. This would be particularly true in the case of crystals designed for tube-type transceivers and those being used with transistor-type transceivers.

No Load SR-150 Transceiver. *I am cramped for space and put up a folded dipole for use with my SR-150 transceiver. I thought that would solve my problem, but now the transceiver won't load.*

I would be surprised if you got anything out of the SR-150 since it is designed to feed a 50-ohm coaxial cable. Even inserting a balun between the 300-ohm lead-in and the SR-150 will not do you any good. Your only practical solution is to build your own antenna coupler to match your transmitter to a balanced line. Some good designs for antenna couplers appear in *The Radio Amateur's Handbook*, 43rd edition, 1966, on page 355.

The "Greenwood" Album. *A couple of old timers have been talking about a book that lists all of the radio equipment made after 1905. My public library says there isn't any such thing.*

It is unlikely that your public library has a copy of the Harold Greenwood, W6MEA, "Pictorial Album of Wireless and Radio, 1905-1928." This book was published six years ago and is the only one we know of covering antique radio and wireless equip-

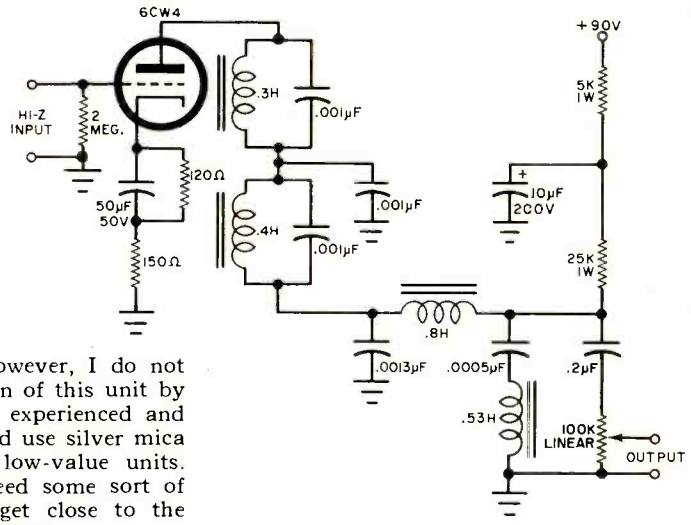
ment. Only 400 copies are left unsold and I would suggest that you get your check into the mail. The Greenwood book is available only from Paul Giganti, W6GVY, 2429 San Carlos Ave., San Carlos, Calif. 94070. The price (postpaid) is $3.

Cathode Ray Screen. *While browsing through a store specializing in military surplus electronics I saw some big cathode ray tubes with a "P-21" screen. Would these have been a bargain and would I ever have a use for one of them?*

No, you would probably never have use for a cathode ray tube having a P-21 screen. This tube is for radar display purposes and has a medium-to-long persistence (about 0.8 second). The scope traces are an orange color.

Scratch the Scratch on 78. *I'm a hi-fi nut who still loves to hear some of the old 78-r/min records. But many of my records are really noisy and although I have put some on tape, I would like to know what could be done to curb some of the scratch without losing too much quality?*

I like the scratch filter shown below. The attenuation is over 40 dB for everything above 8000 hertz. Because of the possibility of hum pickup, however, I do not recommend the construction of this unit by anyone other than a very experienced and careful builder. You should use silver mica capacitors for all of the low-value units. You will probably also need some sort of an inductance bridge to get close to the recommended inductance values.



This scratch filter should be inserted between your phono pickup and the first audio stage in your amplifier. An "AUX" input would be ideal.

Scope Problem. *I have an oscilloscope that I assembled from a kit. I have trouble keeping a pattern or trace centered because of horizontal drift. The manufacturer advised changing horizontal sweep tubes. This was done but without success. What do I do now?*

In writing your "Information Central" department, be sure to tell us the model and manufacturer of your equipment. Frequently, there are solutions to these problems that even the manufacturer may not have diagnosed. Due to lack of data in this case, all I can suggest is that poor voltage regulation is the most probable cause of a horizontal drift. If you cannot lock on a 60-hertz sweep, suspect every capacitor associated with the horizontal sweep circuit. If the pattern stabilizes after the scope has reached its ambient operating temperature, it is rather improbable that resistors or potentiometers are the source of the instability. Try substituting some of the more obvious capacitors around the 0.1 µF value that feed the horizontal sweep to the remainder of the scope circuit.

Those GE Universal Transistors. *It's all well and good for GE to claim that its 11 universal replacement transistors can be used as substitutes for hundreds of other "2N" transistors, but what are the real specifications?*

To our knowledge, General Electric has never published any specifications for its universal replacement transistor line bearing catalog numbers GE-1 through GE-11. However, as close as we can come to it, the GE-1 has characteristics comparable to the 2N597, and 2N802 through 2N814 family. The GE-2 appears to be very similar to the popular 2N404. The GE-4 is much easier to pin down and seems to have characteristics similar to the 2N442. The GE-10 appears to be very near to the 2N1983 through 2N1988 family.

Power Line Buzz. *When it rains, all I can hear on the AM band is a loud raucous buzzing sound. The TV receiver is affected, but not as much as the AM radios. When*

the weather is clear and dry, we have no trouble. Is there anything I can do about it?

Yes, I would call your local power company and report this problem since it is indicative of severe power line leakage. The noise itself may be due to dirty high voltage insulators, a bad distribution transformer or a poor grounding system. In any case, the power company should be glad to know about this noise.

EICO 753 Dial Slippage. *My* ELCO *753 transceiver is giving me excellent service but I have some ball drive slippage in the tuning mechanism. Is there anything I can do to solve this problem?*

Yes, but first review the installation steps in the assembly manual (pp. 24 & 25), starting at step 5. Loosen the mounting screws and mechanically align the ball drive and tuning capacitor. Retighten the screws and remove the C-washer from the rear of the tuning capacitor rotor shaft. Check the tuning capacitor mounting screw that comes from below the chassis between the front frame of the tuning capacitor and the first rotor plate. If this screw is rubbing against the rotor plate, replace it with a slightly shorter screw.

Waveguide Symbols. *Please publish the symbols for the following: rectangular-to-circular waveguide transducer; circular wave guide; attenuator; and directional coupler.*

These symbols are seldom seen by radio amateurs, but often appear in technical articles dealing with radar and military electronic equipment. More and more hams are becoming interested in microwave experimentation. The use of waveguides—called "plumbing"—is a fascinating side to our hobby.

RECTANGULAR TO CIRCULAR TRANSDUCER

CIRCULAR WAVEGUIDE

WAVEGUIDE ATTENUATOR

DIRECTIONAL COUPLER

Communications History. *I need some background history on communications—telegraph, radio and TV. Isn't there some inexpensive, but comprehensive book on the history of communications?*

There are lots of books on the history of the various forms of communications and your public library should be able to supply you with a list of the most significant volumes. However, for a short, concise history of electrical communications, I suggest you write to the Federal Communications Commission, Washington, D.C. 20554 requesting a copy of Information Bulletin No. 7G (March 1966). This 11-page bulletin is a fine summary of communications from smoke signals to subscription TV.

Phone Patch Trouble. *I know that r.f. is getting into my phone line and making my phone patch worthless. What can I do?*

Insert an r.f. filter between the leads connecting your phone patch to the telephone. Do this by inserting a 2.5-mH r.f. choke in each line. Bypass each side of each r.f. choke (4 points) with 0.01 μF ceramic capacitors.

Transformer Color Coding. *I picked up a surplus power transformer that has 12 leads—all color coded. I know about the black, red, yellow, green, and brown leads, but what is the pair of grey leads?*

The grey leads (really slate color) are those of the third filament winding. If this winding is center tapped, the lead would have slate/yellow striping.

FM Terms. *Please explain the terms "deviation ratio" as applied to FM broadcasting and "guard band" as applied to TV broadcasting.*

The "deviation ratio" is the ratio of the maximum change in the broadcast carrier frequency to the highest audio modulation frequency. The "guard band" in television is a vacant 250-kHz space that is usually provided at the high frequency end of each TV channel.

Substitute 1LE3 Tube. *I own an old Zenith short wave radio and my main problem is getting a replacement for one of the tubes. The tube is a 1LE3.*

Your receiver is an old-timer and the 1LE3 tube has been discontinued. Unfortunately, the 1LF3 which is a logical replacement has also been discontinued. The latter tube was cataloged by Allied Radio Corp. up until several years ago. It is doubtful that any of the 1LF3 tubes are available in the United States.

CB Linear Amplifier. *When I'm 18 years old and get my CB ticket, can I hook a linear amplifier up to my 100-milliwatt rig?*

(*Continued on page* 105)

AMATEUR RADIO

By **HERB S. BRIER**, W9EGQ
Amateur Radio Editor

WORLD PEACE AND AMATEUR RADIO

WOULD YOU BELIEVE that the most famous radio amateur in Japan lives in San Francisco, California? It's true; he is Ray Eichman, WA6IVM, who has QSO'd over 3500 different Japanese radio amateurs, many of them 50 or more times. What does this have to do with world peace? Well, when General Dwight D. Eisenhower was President, he sponsored the "People to People Program" to promote world peace through understanding. Radio amateurs have been—and still are—in a unique position to pursue this program, and WA6IVM's contribution is an outstanding one.

Ray's story begins in early 1959. Then a new Novice, he worked his first, honest-to-goodness DX—a Japanese station—on 15 meters. From that time on, JA call letters began appearing regularly in Ray's logbook; and the more JA's he worked, the more impressed he became with their courtesy, friendliness, and good operating habits. Learning that many Japanese amateurs knew only enough of the English language to exchange signal reports, names, and weather reports, Ray started studying Japanese in night school. Two years later, he was able to "rag-chew" on phone or CW with the JA's using either *Romaji* (conversational) or *Hirigani* (syllabic) Japanese.

By 1964, Ray had worked over 2000 different JA's, and the urge to visit them in their own land became overpowering. So he and his wife mortgaged the family cars, drained their bank account, and took off for Japan armed with the names and addresses of hundreds of Japanese amateurs and 1000 blank QSL cards. All of the latter were passed out before they were home again.

The Eichmans traveled over 2000 miles in Japan—but not a mile over the regular tourist routes. Instead, wherever they went, they were the guests of Japanese amateurs and their families. Ray knew them all, their joys, their problems, their plans. Every meeting was like a family reunion.

After the Eichmans' return from what Ray calls "the land of the friendliest hams," he resolved to try to work all of the active JA's. At the last count, he had worked some 3538, most of them many times, and over 2000 of them on 40 meters. Practically every contact is a friendly conversation, and not just a "hello-goodby-please-QSL" formality.

While WA6IVM now uses high power and beam antennas, he has worked many JA's and other DX stations with less than 75 watts and a simple antenna. And the aver-

AMATEUR STATION OF THE MONTH

We are proud to select the station of Ray Eichman, WA6IVM, as Amateur Station of the Month for April, and are sending him a one-year subscription to POPULAR ELECTRONICS. For the story of Ray's adventures in amateur radio and his public service activities, see text above. If you would like to enter our monthly photo contest, submit a clear picture of your station—with you at the controls—and some information about your amateur career and the equipment you use. Even if you do not win, your photo may be used if space permits. All entries should be mailed to: Amateur Radio Photo Contest, c/o Herb S. Brier, W9EGQ, Amateur Radio Editor, Box 678, Gary, Indiana 46401.

age JA he works uses a 15- to 25-watt transmitter and a simple dipole or vertical antenna; only a few of the Japanese hams run high power and sport high-gain beams.

Ray does not spend all his on-the-air time working Japan, however. He is also an avid, all-around DX chaser, contest operator, and certificate collector. One certificate that he is especially proud of shows his honorary membership in the Japanese Blind Ham's Club; he sells seals similar to Christmas and Easter seals for the club.

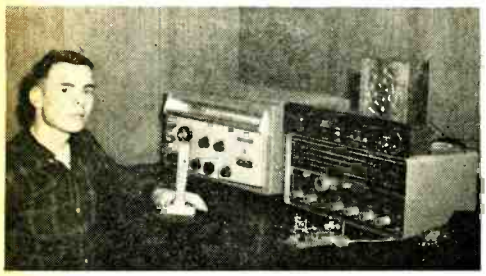
Some months ago, Ray was asked if he would teach amateur radio to a group of handicapped young men and women at the Recreation Center for the Handicapped, Inc., in San Francisco, because of the tremendous therapeutic value it would have for them. Ray accepted the challenge and recruited Art Messineo, W6UDL, to help him. Each Thursday, for several hours starting at 7 p.m., Ray and Art teach their 14 "kids" code, theory, and math, and advise them on family matters and what have you. (Two members of the class have married each other since it began.)

One week Art teaches code and Ray teaches theory; the next week, the tasks are reversed. Most of the teaching is "by ear," depending upon the special needs of the individual student and the ingenuity of Ray and Art to devise methods—such as special keys for sending the code—to meet them.

The Recreation Center's amateur station and antennas have been installed, the latter by members of the San Francisco Radio Club. As soon as one of the students earns a General Class license, he or she will become trustee for the station license, and the Center will be on the air—probably before you read these lines.

Italian Government Honors W6MLZ. Another "Ray," who also hails from California, has been honored for his efforts in connection with handicapped people. In Genoa, Italy, last Columbus Day, Senator Guido Carbellini, Italian Minister of Scientific Research, presented to Ray Meyers, W6MLZ, Santa Gabriel, Calif., the 1966 Columbus Gold Medal Award for Humanitarian Service. The award was in recognition of Ray's work in teaching radio communication techniques to the physically disabled.

W6MLZ founded the "International Handicappers' Net" on 14 MHz phone, and invented special radio equipment for blind operators and those confined to iron lungs. He and his wife attended the presentation ceremony as guests of the Italian government and received "red carpet treatment" during their entire stay in Italy.



Stark simplicity seems to be the motif at the amateur station of Charles Barenfanger, WA9OPW, Vandalia, Ill. Chuck keeps his Johnson "Invader" transmitter and Hallicrafters SX-111 receiver tuned up on 80- and 40-meter CW, and is just a few cards away from his Worked All States certificate.

Of all the equipment in the shack of John Meyer, WA3EGY, Cheverly, Md., the big worker is the Heathkit "Twoer"—it has made 70 contacts so far with the aid of an 11-element beam. Currently under construction is a 2-meter kilowatt transmitter.

One Land QSO Party. To participate in this QSO contest, you operate any 24 hours between 0000 GMT, April 29, and 2400 GMT, April 30, near 3520, 7060, 14,080, 21,050, 28,020 kHz (CW), and/or 3820, 7220, 14,260, 21,380, 28,560 kHz (phone), and on all Novice frequencies. Amateur operators outside of New England work New England stations; New England operators work the world.

Each station may be worked once per band and mode, and a complete contact consists of sending and receiving serial number, signal report, state, county, and the operator's name. Count one point for each complete exchange (five points for Novice contacts); and multiply the contact points by the sum of the states and counties worked.

Send complete, *legible* logs to Carl Porter, 19 Penniman Terrace, Braintree, Mass. 02184, not later than June 15. Include a stamped return envelope if you want a list of the winners.

(*Continued on page* 118)

ON THE CITIZENS BAND

By **MATT P. SPINELLO,** KHC2060, CB Editor

THE AMOUNT OF MAIL that has crossed your CB Editor's desk since the first of the year would seem to indicate that a whole new crop of Citizens Radio users has joined the 800,000 licensees now authorized to operate in the 11-meter band. We are answering some of the more important requests for information in this month's column in an attempt to set the record straight for both CB users and non-users.

Q. *What is the Federal Communications Commission doing to reprimand the stations misusing the Citizens Band, and why don't we hear of citations being issued to violators?*

A. It's no secret that the monitoring facilities of the FCC are understaffed. But the FCC is not sitting idly by. The OTCB desk receives a regular report of citations issued to CB violators in addition to orders for license revocation. A recent report (covering a six-week period) listed citations and revocations in 22 states.

The FCC is currently putting the clamps on the following: antenna height violators; communications on channels reserved for stations using the same license; failure to identify a station with a proper call-sign; operation beyond authorized frequency tolerance; excessive power output; failure to post current authorization for a station at a conspicuous place; use of a station as a hobby or diversion; and attempting to communicate over a distance of more than 150 miles.

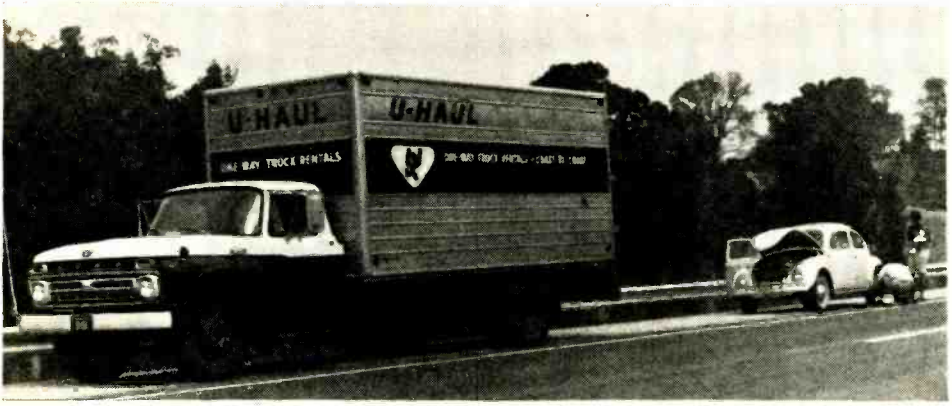
Q. *We have been thinking of adding CB radio to our farm vehicles for direct communications with the barn. However, friends have warned us that all of the channels are very crowded.*

A. It is possible that there is heavy air traffic in your area, but this should not limit your use of CB radio. Since your application would appear to be "personal and/or business use," you have a choice of any of the 23 channels allocated, so long as your conversations are limited to units of your own station. Units with different call-signs may contact one another *only* on channels 9, 10, 11, 12, 13, 14 and 23. You should use one of the other 16 channels.

Q. *I have just received my CB license. Where can I get more information on how to install, operate, and maintain my mobile and base stations?*

A. Distributors of electronic equipment generally have a technician on hand who can answer most of your questions and who usually has a supply of manufacturers' literature on hand that may be helpful. If you're more interested in physical help, team up with someone who has used CB gear for some time. If you're looking for all

CB in a submarine? Yes, and no. The launching and surface maneuvering of the "Cubmarine," built by the Perry Submarine Company, are ably assisted by Lafayette "Dyna-Com 5" walkie-talkies. The "Cub" was used in the recent search for the lost atomic bomb off the coast of Spain. These walkie-talkies are regular CB types with 5 watts input and 3-channel switching.



CB EN ROUTE—IS IT WORTHWHILE?

Several months ago I drove a truck from Maryland to New Mexico using CB to maintain contact with my wife who was driving a car along the same route. The material below is abstracted from my log.

Asheville, N.C. Channels 7, 9, and 11 very crowded, but KOM2082 gave good directions to the Biltmore Estates—a major tourist attraction.

Nashville, Tenn. Heavy traffic on channel 11 with numerous travelers getting road information.

Rockwood, Tenn. Billboard said that the Plateau CB Club was monitoring channel 11, but all was quiet the morning that we passed through.

Jackson, Tenn. Another sign said listen in on channel 11, but no one was monitoring. Finally contacted KDD8766 who reported that the Jackson CB Club had moved over to channel 9.

Forrest City, Ark. Received good information from KOR3217 on best restaurant.

Melvern, Ark. KMR3939 answered on channel 11 with directions on best road to Texarkana.

Highway 180, Tex. Contacted en route by KOV0651 just returning from vacation who reported that roads to Carlsbad Caverns, flooded the week before, were now passable.

Lamesa, Tex. Routing instructions and good motel suggestion from KKV4527.

El Paso, Tex. Received new highway routing instructions from KOV1841.

Las Cruces, N. Mex. Got lost at night, but saved by KLE2534 who, realizing that KKI1395 was a stranger, took extra time to pronounce and spell the street names.

Having transceivers in both vehicles proved even more valuable. At one point, my wife reported a flat on the car, and I stopped the truck to change the tire (see photo above). Without CB, I might have driven another 25-50 miles before realizing that something was wrong. Three cheers for CB!

—Alex F. Burr, KKI1395

the details, get a copy of the 1967 COMMUNICATIONS HANDBOOK, available at your local newsstand or directly from Ziff-Davis Publishing Co., One Park Avenue, New York, N. Y. 10016, for $1.25 postpaid.

Q. *I have followed your reports on rescue squads and emergency teams for the past four years. How can I find out if there is such an organization in my area, and how can I join it?*

A. If you're in a hurry, we suggest walking to the nearest intersection and flagging down the first car you see with a CB antenna attached. Usually, local or area CB'ers can give you information about clubs or teams in the vicinity whether they belong to them or not. Another method would be to look for a CB antenna on a housetop, and politely explain your problem to the home owner.

If you strike out on both of these attempts, send your request for information with a self-addressed, stamped envelope to: Matt P. Spinello, CB Editor, POPULAR ELECTRONICS, One Park Avenue, New York, N.Y. 10016. If you live in a small town or rural area, be sure to indicate which of the larger towns in your area is nearest your home.

"The Taller The Tower." Don't ever take a bet that you can get as much range from one of a matched pair of walkie-talkies as the next guy—especially if the "next guy" is Henry Hite. We've heard of people standing on rooftops to get more range from hand-held transceivers, and as far back as the first days of CB radio it was assumed that raising the average base station antenna two feet might add a few miles to transmitting and receiving range.

This particular bet was prepared as a spoof on your CB Editor. Although reluc-

(*Continued on page* 112)

SOLID STATE

By **LOU GARNER**, Semiconductor Editor

THE USE OF integrated circuits in consumer products is increasing at an accelerated pace. Last year several major manufacturers started to include IC devices in their TV sets (RCA) and table-model radio receivers (GE and Philco). Heath followed suit shortly thereafter with a TV receiver kit featuring an IC. H.H. Scott, a major hi-fi equipment producer, is now using IC's in the i.f. stages of its better line of FM receivers and tuners. And the latest entrant in the field is Westinghouse Electric Corp., with an IC portable phonograph. The new phonograph uses a conventional record changer, but the familiar amplifier has been replaced by an IC measuring only 0.112″ x 0.085″ and equivalent, performance-wise, to 39 components, consisting of transistors, diodes, and resistors.

But the IC news is not limited to the domestic front. Two major Japanese manufacturers, Sony Corp. and Matsushita Electronics Corp., are producing radio receivers using IC's, and another firm, Victor Co. of Japan Ltd., is selling a 25-inch color TV set with a hybrid IC in its sound channel.

The Military, too, is going for IC's in a big way, not only in communications and computer applications but, more recently, in the production of IC proximity fuses. A World War II development, the proximity fuse is a miniature transceiver used in artillery shells and bombs. In operation, the device senses its approach to a target by measuring the Doppler shift between shell and target. At a preset distance, its detector circuit, activated by a reflected radio signal, detonates the warhead charge.

Another recent development in the field permits smaller firms to design custom IC's for their own products without the high investment cost of a complete manufacturing facility. A sort of "do-it-yourself" IC kit, the new item is an open-cased monolithic silicon chip measuring only 0.086″ x 0.124″, but containing 60 components. The user interconnects the various elements as needed to assemble his own custom circuit. Produced by Westinghouse Electric Corp., the IC kit has been dubbed the "Insta-Circuit" and is available in both flat-pack and TO-5 configurations. Suitable for manufacturers, schools and laboratories, the Insta-Circuit is definitely not a hobbyist item, since the special microscope-equipped wire bonder required to make the final circuit connections costs almost as much as a small car. The circuit chips themselves sell for less than $40 each in unit quantities and less than $30 each in quantities of 50 to 400.

A new manufacturing process at Eburn Industrial Research Corp. (Hingham, Mass.) allows IC designers to pack 100 times as much circuitry into the same area occupied by a conventional transistor.

Reader's Circuit. Agreed that simple AM broadcast-band receiver circuits are literally "a dime a dozen," the circuit in Fig. 1, which was submitted by reader Doug Zimmer (14332 35th N.E., Seattle, Wash.), combines a number of interesting features that

CORRECTION!

Through a typographical error, the price of the new Model RS-30 low-voltage power supply available from Aul Instruments, Inc. (24-13 Bridge Plaza North, Long Island City, N.Y. 11101) was listed as $5 in last month's column. The price is actually $45.00.

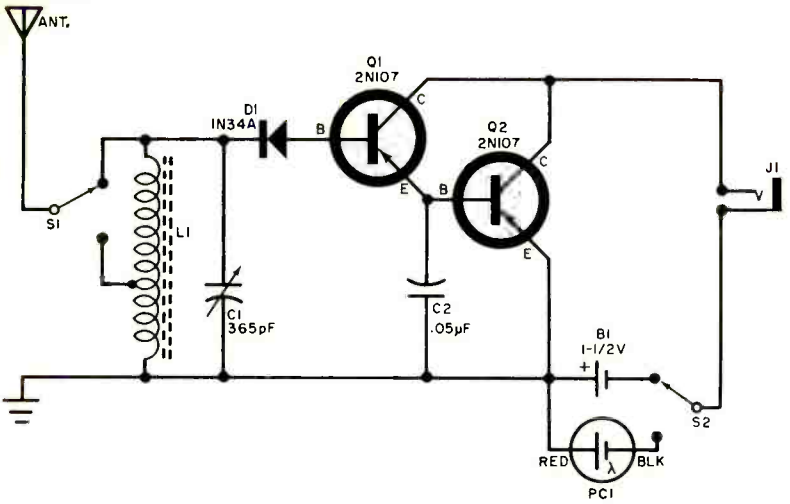


Fig. 1. Two-transistor AM broadcast-band receiver circuit submitted by reader Doug Zimmer features a Darlington pair amplifier (Q1 and Q2), and a power switch that lets you select either a chemical battery, B1, or a sun-powered battery (PC1).

make it suitable for demonstration or test purposes.

Doug has employed a standard tapped antenna coil, with the tap serving as a means of matching the antenna. In addition, he has used a Darlington pair amplifier (*Q1* and *Q2*) and a dual d.c. supply, permitting the selection of either a chemical battery (*B1*) or a sun-powered battery (*PC1*) as the power source.

Radio-frequency signals picked up by the antenna are selected by tuned circuit *L1-C1* and detected by diode *D1*. Switch *S1* provides optimum match for both long and short antennas, insuring the best compromise between selectivity and sensitivity. The detected audio signal is amplified by *Q1* and *Q2* and applied to an earphone plugged into output jack *J1*. Capacitor *C2* serves to bypass the r.f. signal.

Switches *S1* and *S2* are s.p.d.t. toggle, slide, or rotary types. Coil *L1* is a tapped loopstick antenna coil (Superex VLT-240 or similar) and *C1* is a standard 365-pF variable capacitor. A tubular paper capacitor or ceramic unit can be used for *C2*; working voltage is not critical. Diode *D1* is a general-purpose type similar to a 1N34A and *Q1* and *Q2* are low-power *pnp* types (typically, CK722, 2N107, or SK3003). An open-circuit phone jack is used for *J1*.

Either a penlight cell or standard flashlight cell will be suitable for *B1*; *PC1* is an International Rectifier type S1M silicon solar cell. Doug recommends moderate impedance (500- to 5000-ohm) magnetic earphones. And you can use either a printed circuit or point-to-point wiring when building this receiver.

Manufacturer's Circuit. An interesting experimental phase shifter circuit is shown in Fig 2. One of the 20-plus practical circuits described in a four-page folder recently published by Siliconix, Inc. (1140 W. Evelyn Ave., Sunnyvale, Calif.), the phase shifter permits a continuous adjustment of the relative phase difference between its input and output signals. It can be used for test purposes or to demonstrate the concept of phase shift. It is particularly valuable for demonstrating the changes in standard Lis-

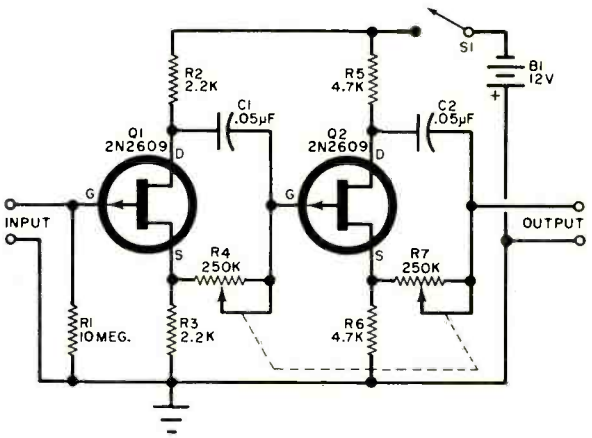


Fig. 2. One of the many practical FET circuits described in a recent folder from Siliconix, Inc., each stage of this phase shifter permits continuous adjustment of phase shifts from 0° to 180°.

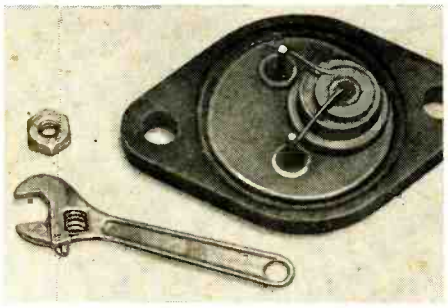
sajous figures as a signal's phase angle is varied.

The phase shifter consists of two cascaded split-load amplifier stages with appropriate signal-combining phase-shifting networks between the drain and source output points. Each stage provides from 0° to 180° phase shift. Resistor *R1* serves as *Q1*'s gate return resistor and as the input load. Resistors *R2* and *R5* act as drain loads while *R3* and *R6* serve as individual source loads. Combinations *C1-R4* and *C2-R7* form, respectively, the first-and second-stage signal-combining network, with the degree of phase shift determined by their adjustable resistive elements (*R4* and *R7*). Operating power is furnished by a 12-volt battery, *B1*, controlled by s.p.s.t. switch *S1*.

Standard components are used in the instrument. Transistors *Q1* and *Q2* are FET 2N2609's. All resistors are half-watters; *R4* and *R7* are ganged potentiometers. Capacitors *C1* and *C2* are high-quality ceramic or plastic film types. Switch *S1* can be a toggle, slide, or rotary switch, as preferred. A variety of 12-volt battery power packs can be used for *B1* including two 6-volt portable A types in series, or eight series-connected penlight or flashlight cells. You can also power the phase shifter with a line-operated d.c. power supply if you wish.

Observe good wiring practices when assembling the device, and keep all signal leads short and direct. The "Phase Shifter" can be wired on a suitable etched circuit board or on a perforated phenolic board, and housed in a small metal utility box. A sine-wave audio signal generator can be used as the prime signal source for checking phase shifts.

OVERSIZE POWER TRANSISTOR



On April 1, the Lou Garner Enterprises announced the development of the BMB transistor. Rated at a maximum free air dissipation of about 10,000 watts, the new transistor is shown in the accompanying photograph—note how the elements dwarf the nut and crescent wrench. Beta values have not been calculated, but the alpha is reported to be close to 1.0001 under typical operating conditions. Distribution and quantity prices have not yet been firmly established for this breakthrough. Further details will be found on page 106.

Transitips. Although possessing extremely-high input impedance, insulated-gate field-effect transistors (IGT's, IGFET's, MOST's, or MOSFET's) can be damaged quite easily by stray electrostatic charges. To protect these devices against such damage during storage and shipment, semiconductor manufacturers use techniques like wrapping the transistors in foil, twisting or soldering the lead tips together, or shorting the leads by means of a metal eyelet. However, none of these techniques provides adequate protection when the transistor is prepared for installation in a circuit since the leads must then be separated.

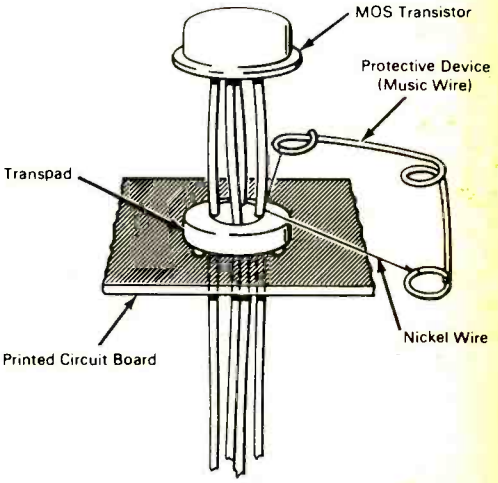


Fig. 3. This is a simple device used by NASA to protect MOS transistors from being accidentally damaged by the application of an electrostatic potential across the leads while the transistor is being handled or assembled in a circuit. A loop of flexible nickel wire is attached to a music wire spring that is slipped over the transistor's case and released, shorting together all of the leads.

A recently published NASA "Tech Brief" describes a simple and inexpensive device (Fig. 3) for preventing accidental damage when MOSFET's are actually installed in a circuit. If you do work with these transistors, you may want to use a similar device. It is made from short pieces of 0.033-inch

(*Continued on page* 106)

ENGLISH-LANGUAGE BROADCASTS TO NORTH AMERICA

FOR THE MONTH OF APRIL

Prepared by ROBERT LEGGE

TO EASTERN AND CENTRAL NORTH AMERICA

TIME—EST	TIME—GMT	STATION AND LOCATION	FREQUENCIES (MHz)
7 a.m.	1200	Copenhagen, Denmark	15.165
7:15 a.m.	1215	Helsinki, Finland	15.185 (Tues., Sat.)
		Melbourne, Australia	11.71
6 p.m.	2300	London, England	9.58, 11.78, 15.18
		Moscow, U.S.S.R.	7.15, 7.205, 9.665, 9.685
6:45 p.m.	2345	Tokyo, Japan	15.135, 17.825
7 p.m.	0000	London, England	7.13, 9.58, 11.78
		Moscow, U.S.S.R.	7.15, 7.205, 9.665, 9.685
		Peking, China	15.06, 17.68
		Sofia, Bulgaria	9.70
		Tirana, Albania	7.263
7:30 p.m.	0030	Budapest, Hungary	9.833, 11.91
		Johannesburg, South Africa	9.675, 11.90
		Kiev, U.S.S.R.	7.12, 9.665 (Mon., Thurs., Fri.)
		Stockholm, Sweden	11.805
7:50 p.m.	0050	Vatican	7.27, 9.645, 11.77
8 p.m.	0100	Berlin, Germany	9.56, 9.73
		Havana, Cuba	6.17, 11.76
		London, England	6.11, 7.13, 9.58
		Madrid, Spain	6.13, 9.76
		Moscow, U.S.S.R.	7.15, 7.205, 9.665, 9.685
		Prague, Czechoslovakia	5.93, 7.345, 9.55, 11.99
		Rome, Italy	9.63, 11.81
8:15 p.m.	0115	Berne, Switzerland	6.12, 9.535, 11.715
8:30 p.m.	0130	Bucharest, Rumania	7.195, 11.94
		Cairo, U.A.R.	9.475
		Cologne, Germany	6.075, 9.64
		Hilversum, Holland	9.59
9 p.m.	0200	Lisbon, Portugal	6.025, 6.185, 9.68
		London, England	6.11, 7.13, 9.58
		Moscow, U.S.S.R.	7.15, 7.205, 9.665, 9.685
		Stockholm, Sweden	11.805
9:30 p.m.	0230	Beirut, Lebanon	11.76
10 p.m.	0300	Bucharest, Rumania	7.195, 9.57, 11.94
		Budapest, Hungary	9.833, 11.91
		Havana, Cuba	6.135, 6.17
10:30 p.m.	0330	Accra, Ghana	6.11
		Prague, Czechoslovakia	6.095, 7.345, 9.55, 11.99

TO WESTERN NORTH AMERICA

TIME—PST	TIME—GMT	STATION AND LOCATION	FREQUENCIES (MHz)
6 p.m.	0200	Melbourne, Australia	15.22, 17.84
		Tokyo, Japan	15.135, 15.235, 17.825
6:50 p.m.	0250	Taipei, China	15.125, 15.345, 17.72
7 p.m.	0300	Moscow, U.S.S.R.	15.14, 15.18, 17.76
		Peking, China	9.457, 11.82, 15.095
7:30 p.m.	0330	Stockholm, Sweden	11.805
7:45 p.m.	0345	Berlin, Germany	9.65, 11.73
8 p.m.	0400	Sofia, Bulgaria	9.70
8:30 p.m.	0430	Budapest, Hungary	9.833, 11.91
8:45 p.m.	0445	Cologne, Germany	6.145, 9.735
9 p.m.	0500	Berne, Switzerland	9.655
		Moscow, U.S.S.R.	9.54, 11.755, 11.85

SHORT-WAVE LISTENING

By **HANK BENNETT,** W2PNA/WPE2FT
Short-Wave Editor

SPRING CATCH—NORTH SEA HOSPITAL SHIP

THE brand-new 1967 Edition of the *World Radio TV Handbook* is at hand and contains some interesting material on the hospital and church vessel "De Hoop" which will be serving the fishing fleets around Iceland and Greenland. The "De Hoop" will put out to sea March 28 and will cruise in the northern part of the North Sea until April 18. It will go to sea again on April 25 and will be in the central part of the North Sea until May 16.

According to the 1967 WRTH, the "De Hoop" will broadcast religious services from the on-board chapel each Sunday at 0930-1030 and 1745-1830 on 2316 kHz. Weather forecasts will be given on 2201 and 2316 kHz, and transmissions will also be made on 2056 and 2181 kHz. The power output of the transmitter is 500 watts.

All transmissions will be in the Dutch language except when the hospital ship is giving assistance to foreign ships; at such times English or German will be employed. Verification will be by letter and reception reports should be addressed to DAMRAK 95, Amsterdam-C, Holland.

Dale Marks, WPE9HMY, of Neosho, Wis., DX'es with a Hallicrafters S-108 receiver. An SWL for only a short time, Dale has already logged 7 countries.

The main receiver of B. G. Heiser, WPE8ITB, Ypsilanti, Mich. (right), is a Hammarlund HQ-100A, backed up by a Hallicrafters S-38E. To date B.G. has 60 countries logged, with 42 of them confirmed.

Hard Life for the "Pirates." Two of the AM broadcast-band "pirate" stations operating from former anti-aircraft towers in the Thames River estuary have been fined 100 pounds for illegal broadcasting. One of the broadcasters, *Radio 390,* on 773 kHz, is now off the air pending a legal appeal as to whether or not the British jurisdiction covers radio stations which are at least six nautical miles off the English coast. The second broadcaster, *Radio Essex,* on 1349 kHz, was operating as this column went to press. The British government, acknowledging the fact that both stations are in the estuary, is citing a 1958 Geneva International Convention on Sea where an estuary was defined as a bay, and claims that the two radio stations are *not* operating in international waters.

News From the ANARC. The Association of North American Radio Clubs (ANARC) has elected Gerry Dexter, WPE9HDB, of West Bend, Wis., to the office of executive secretary. Gerry replaces Don Jensen, WPE9EZ, of Racine, Wis.

The ANARC is investigating the difficulty in getting verifications from overseas radiotelephone stations on "running marker" transmissions. Reportedly, many overseas telephone stations have adopted a complete non-verification policy because interception and reports on radiotelephone transmissions are illegal, according to the rules set forth

(Continued on page 113)

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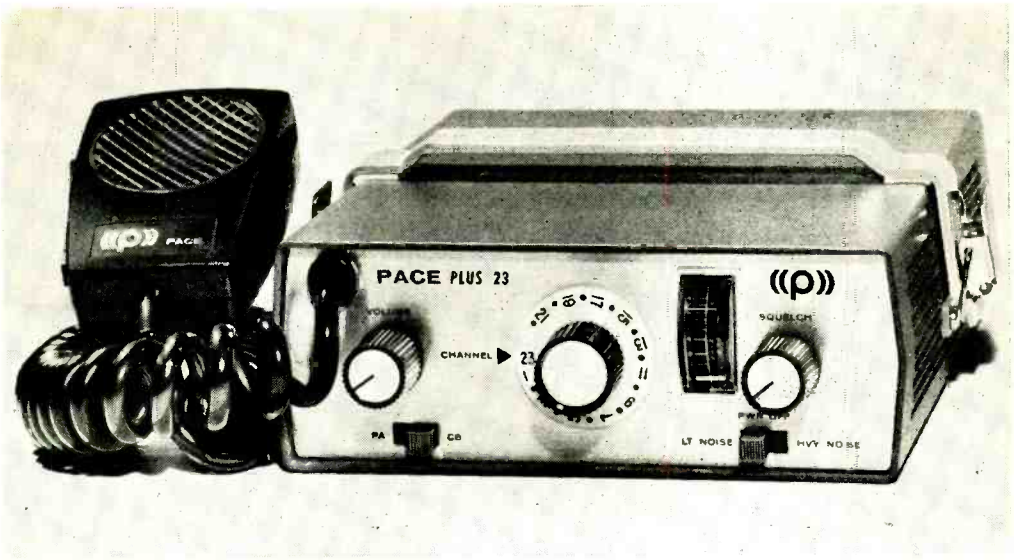
ADAPTABLE TO SELF-PROGRAMMING

Sometimes Subject to Fatigue and Distraction—Requires Motivation
Memory Access Sometimes Faulty—Processes Material Illogically



SOME STRAIGHT-FORWARD TALK ABOUT THE PACE PLUS-23 CB TRANSCEIVER

The PLUS-23 is an all silicon transistor, all solid state Citizen Band 2-way radio, manufactured by Pace Communications Corp., priced at $199.00 with all channels supplied. Ask any proud PACE owner, or ask your dealer for an in-field comparison test. You will find the PLUS-23 even outperforms its own specs. This is because we guarantee our sets will perform to specifications under the worst possible conditions—not under ideal or laboratory conditions.

PACE is a pioneer in all solid state CB design, specializing in all silicon transistor 2-way radios. The advantages are many: You don't risk a run-down car battery because the current drain is so low; you get a compact unit that fits conveniently under the dash—not the large, knee-knocking chassis of a tube set; you get reliability that means top performance on a below-zero winter morning or when it's 100 degrees in the desert sun; you get rugged dependability that keeps on operating after a day-long trip over bumpy mountain roads.

Reliability is the name of the game at PACE. That's why we clip and bend every component lead by hand. And test every PLUS-23 on a vibration stand. We also check every set for all of the published performance specifications—even operation on a weak battery or high voltage conditions. A signed process report goes with every radio—like a pedigree. Take a look at one and see for yourself how we take the guesswork out—and build performance in to every PLUS-23. We build in dependability too. You get full diode protection plus complete AGC at every stage, with heavy duty silicon transistors and lifetime guaranteed circuit boards and computer-verified synthesizer.

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CIRCLE NO. 23 ON READER SERVICE PAGE

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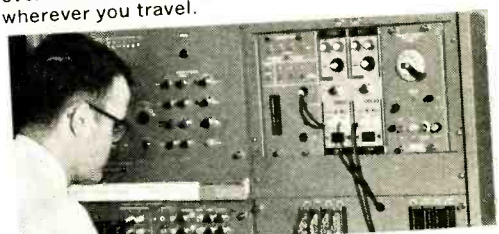

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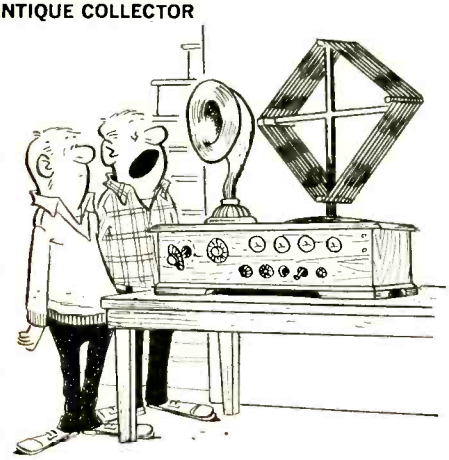

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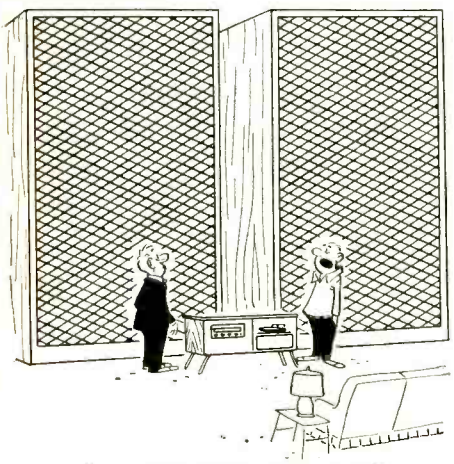
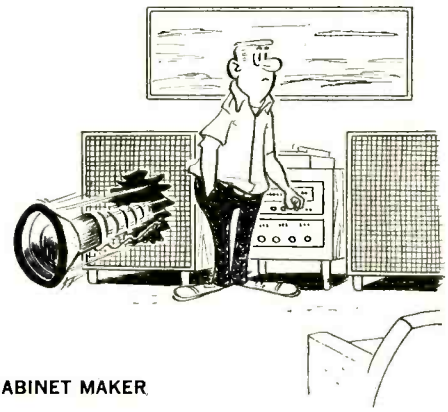


". . . and two 36-inch tweeters."



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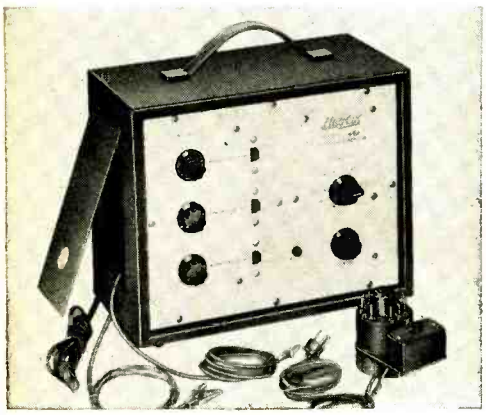
COLOR BAR GENERATORS

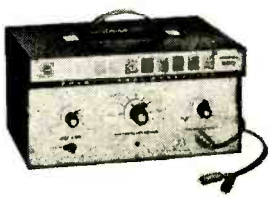
(*Continued from page* 52)

Line And Dot Patterns. Before any convergence adjustments are made, it is essential that the yoke and centering and linearity controls be properly set up. Adjusting these controls after convergence has been accomplished could misconverge the set. Knowing the number of lines in the test pattern, both horizontally and vertically, helps you determine centering and degree of overscan. Some overscan is desirable.

Linearity controls are set for equal spacing between bars. If the ratio of the number of vertical lines to the number of horizontal lines is the same as the aspect ratio of the size of the CRT (4 to 3), then the crosshatch pattern will appear as a series of squares when proper linearity is obtained. Amphenol, Hickok and Jackson, with their 20 vertical lines and 15 horizontal lines, do achieve this ratio. The squares appear to be easier to adjust to than the rectangles that are obtained with different ratios, although it is not difficult to look for equidistant parallel lines. The number of lines is not critical, but there shouldn't be too many lines to cause confusion, or too few lines to cause portions of the screen—particularly at the edges—to be missed.

Generally, the dot pattern is used to set up static convergence in the center of the screen, and the line patterns are used to set up dynamic convergence. Some generators have a control to adjust the thickness of the dots and lines. One-line-thick, two-lines-thick, three-lines-thick, take your choice—it may be a matter of preference. One-line-thick appears to be most desirable, but it is also the most difficult to see. Actually, thickness is not as critical as having a well-defined edge for the dot or line, and having a stable, jitter-free pattern to work with.





Tube-type generators invariably are line-operated, but are portable and suitable for use in the home. In the sampling shown here, in alphabetical order, from top to bottom left, and below, are: Hickok's Model 662, RCA's Model WR64B, Seco's Model 990, and Sencore's CA122B. Other models are available.

The Amphenol 860's single line and single cross-bar patterns make it easier to predict proper centering. This instrument also provides a single-dot display in the center of the screen to facilitate static convergence adjustments. Absence of other dots lets you concentrate your attention on one and the same spot on

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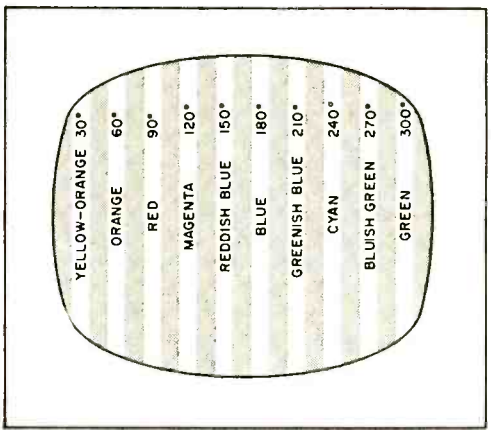
Like mini-skirts, more solid-state generators are making the scene. Here are a few of them: (from top to bottom, left) B&K Model 1245, Lectrotech Model V6B, Mercury Model 1900, Seco Model 900; (above) Hickok Model GC660; (below, left to right) Precise Model 660, and Sencore Model CG135. All models are lightweight and portable.

the screen and the single dot is less distracting than the multiple dot patterns. However, working with a multiple dot pattern is not difficult. If a visual problem does exist, some masking tape fitted around the center of the screen provides relief.

Color Bar Patterns. Makeup of the color signals sent out over the airways is in accordance with a set of standards established by NTSC, and it seems logical to expect a signal generator designed for work on a color TV set to be able to generate such a signal. Some generators do put out an NTSC signal, as mentioned previously. However, most of the test equipment manufacturers, in an effort to reduce the cost of the generators, are producing an offset-carrier signal which is "switched" on and off to create a gated rainbow pattern.

Both the TV set manufacturers and the test equipment people have cooperated to the extent that the service literature for TV sets and for the available test equipment, for the most part, are compatible; and it is possible to accomplish all of the needed chroma adjustments with these rainbow patterns. Several techniques for determining and adjusting for proper color phase have been developed—any of which can be used—but it is best to observe the method prescribed by the service notes for a particular set.



Most color bar generators provide a signal to set up a keyed rainbow pattern having 10 color bars. A different colored bar appears for each 30° of phase shift of the set's 3.58-MHz color-burst oscillator.

The gated (keyed) rainbow color bar

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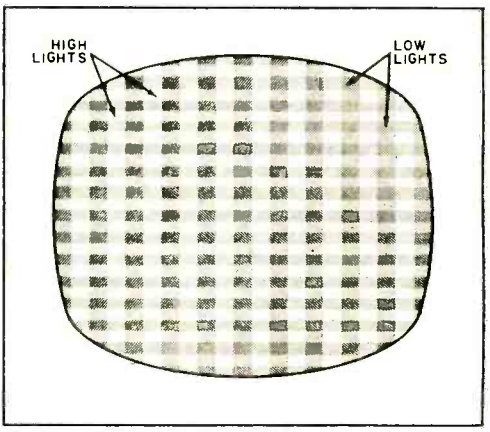
pattern consists of 10 vertical color bars ranging in hue from a yellow-orange bar on the left side of the screen to a green bar on the right side. The other bars in the pattern going from left to right are: orange, red, magenta, reddish blue, blue, greenish blue, cyan, and bluish green. Each bar is well defined and evenly spaced due to a 12-pulse gate action within the generator. One pulse coincides with the horizontal sync pulse and is lost, and another (the next pulse) occurs during sweep retrace and serves as the 0° reference burst signal.

More precise adjustments of the chroma circuits are possible and a closer approximation of a set's behavior to on-the-air signals can be established with an NTSC signal generator. Each color in the NTSC signal has a specific value of saturation and it is possible to produce fully-saturated, full-field primary colors (red, blue, and green) without the use of a CRT gun killer or other gun control. Heretofore, NTSC generators were considered to be laboratory-type instruments in the $350 and up category, but with units selling for about $150, these generators have a renewed opportunity to become more popular.

Regardless of the type of color signal used, a signal level control is a must. Signal levels should be just strong enough to drive the TV set properly, and to avoid overload. The set's ability to achieve proper color sync can be checked out by reducing the signal to a point somewhat below the level where snow appears. Also, in the event that the set is suffering from certain sync problems, a signal containing stronger sync pulses will be helpful. Some generators do have the ability to increase the relative amplitude of the sync pulses.

Clear Raster And Shading Bars. A clear raster, free of snow and noise, is used to make adjustments for purity. While no test equipment is needed to obtain such a clear raster, some generators provide a clear raster function at the flip of a switch. One way to get this type of signal is to modulate the r.f. carrier with a composite sync signal only.

A shading bar pattern, featured in the Heathkit and the Precise generators, consists of a series of wide, vertical, and horizontal bars which resembles a cross-hatch pattern. These bars produce four levels of brightness on the screen to facilitate adjustment of screen and video drive controls to obtain proper gray scale tracking. The brightest level (highlights) occurs where the horizontal and vertical bars cross. The lowest level (lowlights) is the space between the bars. The other two brightness levels stem from the fact that the vertical bars are brighter than the horizontal bars. The Knight-Kit KG-685 produces a 6-level vertical shading bar pattern to accomplish the same purpose.



A stable gray-scale tracking pattern having illuminated areas equivalent to the highlights and lowlights of a normal monochrome picture is easier to observe than a constantly changing televised scene.

It is easier to observe a shading bar pattern than an off-the-air picture which is constantly changing. When gray scale tracking is correct, there is no sign of color tinting anywhere in a black-and-white picture.

A Word of Advice. You should not attempt any adjustment of your color TV set without knowledge of what you are doing or at least without a set of specific instructions. The more experience you have, the more knowledgeable you will be about which color bar generator to get.

If you are absolutely green on the subject, refer to the service notes for your TV set and select a generator that will provide all of the signals and test patterns needed for your set. When in doubt, contact the manufacturer or your test equipment dealer for additional information. —30—

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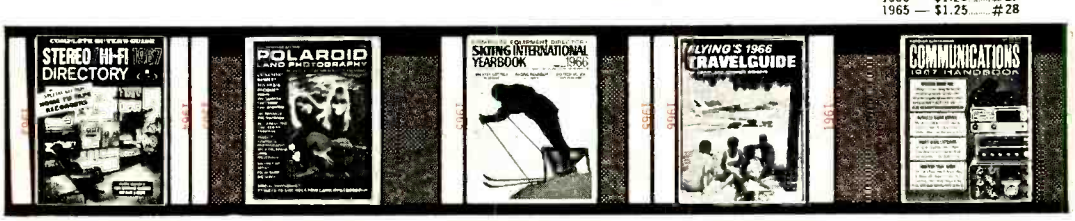

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GETTING MOST FROM CB RIG

(*Continued from page 73*)

er cases, the modulated output could be increased considerably. Note that in every single case the modulated input was increased and the r.f. output somewhat reduced.

Transceiver set number 3 is a very interesting example. This was a kit-type transceiver that had been "improved" (?) by the builder to get more output (illegally). Although the r.f. output was slightly above the legal limit, the maximum possible modulation had been reduced about 30%. Aligning this transceiver for maximum modulation dropped the r.f. output by more than a watt, but simultaneously doubled the amount of modulated output. This not only indicates the gain possible with proper adjustment, but also points up the fact that attempting to increase the output of your set is sometimes not worth the effort.

With a little practice, you should be able to align your transceiver using the method described to obtain optimum CB results. —30—

"I don't know—let's see how it looks on the other side again."

MULTIPURPOSE SIGNAL TRACER

(*Continued from page 47*)

1-millivolt scale will hold for all ranges. You can check meter linearity by successively reducing the input signal to 800, 600, 400, and 200 microvolts and observing the meter reading. Frequency response can be checked by maintaining a constant 1-mV signal while varying the source frequency from 40 hertz to 20 kHz.

Operation. When signal-tracing in receiver r.f. and i.f. circuits, use a demodulator probe at the INPUT binding posts. For audio circuits, a direct probe or shielded lead can be used. Suitable low-cost demodulator probes and direct probes are available commercially in kit form or fully assembled. Or you can build your own demodulator probe, if you wish, following one of the diagrams in Fig. 5.

When this meter is in use, the audio amplifier can be turned off, if desired, by

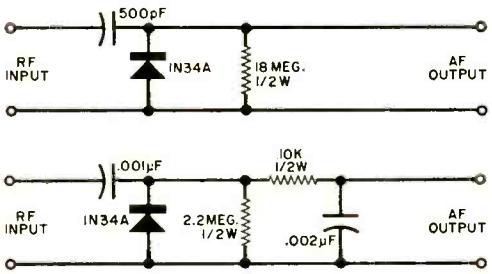


Fig. 5. Either of these circuits can be put together and used as a demodulator probe. However, you may prefer a commercial unit, such as the EICO PSD demodulator probe, for economy and convenience.

turning the GAIN control fully counterclockwise till you get a "click." If you want to use the audio amplifier alone, you can turn off the meter by flipping the METER switch to *off*. The unit's preamplifier is always on when power is applied, and can be used to monitor signals with a crystal headphone.

To use the preamplifier, turn both the meter and audio amplifier off. With the SENSITIVITY control set to 1 mV, the voltage gain will be approximately 200. At the 10-mV setting, the gain is about 20. —30—

ASSIST (*Continued from page 30*)

RU-18 receiver, surplus, type CW-46048D. Installation and operating manuals needed. (Tom Brengle, 5749 Trinity Pl., San Diego, Calif. 92120)

Sun Electric Model G-6600 "Dwell-Tach" tester, circa 1947. Wiring diagram and operating manual needed. (Walter R. Yeary, 3812 Old Brownsboro Hills Rd., Louisville, Ky. 40222)

BC-1066-B receiver, ser. 8694, made by Philco for Signal Corps. Operating manual and band specifications needed. (Dan Sholl, Star Route, Box 189, Naches, Wash.)

Jackson Model 109 "Volt-Ohmmeter." Operating and instruction manuals needed. (Andrew Cuneo, 157 W. Albemarle Ave., Lansdowne, Pa. 19050)

McMurdo Silver Model 906 signal generator; has range of 0.09 to 170 MHz. Schematic and operating manual needed. (Lawrence Palasz, 2521 W. 38 Ave., Hobart, Ind. 46342)

Philco Model 41-287 receiver, code 121, circa 1935; tunes on 3 bands; has 9 tubes. Schematic and [illegible] manual needed. (Allen Lowry, 3387 Lee Rd., Cleveland, Ohio 44120)

Surplus GB6 wave monitor, ser. AW 502, circa 1943. Schematic needed. (Mel Downey, 119 Gawain Dr., Newport News, Va. 23602)

Philco receiver, circa 1939; tunes BC and s.w. from 5 to 18 MHz; has 6 tubes. Dial plate #27-6403 needed. (Gerald Pement, Box 2, Rt. 1, Wellington, B.C., Canada)

Hallicrafters "Continental" receiver; tunes BC and s.w. from 6 to 18 MHz. Schematic and parts list needed. (Vincent Calderheas, 398 Seigniory Crescent, St. Hilaire, Quebec, Canada)

Surplus receiver, type CG-46117, ser. 1410, made for USN by GE, circa 1940; has 8 tubes. Any available information wanted. (George Heser, Nut Plains Rd., Guilford, Conn. 06437)

Hickok Model 198 audio frequency signal generator. Schematic and instruction manual needed. (William Misiek, 405 Royalton Rd., Silver Spring, Md. 20904)

Hickok Model 610A signal generator, ser. 106 10464, circa 1944. Schematic and operating manual needed. (James McCrohan, 119 Brainerd Rd., Boston, Mass. 02134)

Bell Model 2122 amplifier, ser. 43416; has 6 tubes. Schematic, parts list, and source for parts needed. (Robert Gordon, 160-38 12th Rd., Whitestone, N.Y. 11357)

Knight Model KG-70 AM/FM/MPX tuner. Schematic needed. A2/C Emory A. Michau, 36A & E Box 2461 CMR, APO, N.Y. 09132)

Lucor Model 561 tape recorder, ser. 37,886. Pictorial needed. Ronald Vaughan, 222 Bizerte St., Houston, Tex. 77022)

Philips receiver; tunes AM and s.w. on 4 bands; has tuning eye. Schematic and source for parts needed. (Isaac W. Eaves, 10113 Pilot St., Houston, Tex. 77029)

DuMont cathode-ray oscillograph, type 304A. **Precision** Model T62 tube tester. Operating manuals needed. (Fifi Lopez, Box 7565, Mexico City 1, Republic of Mexico)

Concertone Model 1601 ("Binaural") tape recorder, circa 1955. Schematic needed. (E.J. Leaman, 15 B East Islay St., Santa Barbara, Calif. 93101)

Masterwork Model M690A tape recorder. Schematic and operating manual needed. (Thomas F. Feeney, Jr., 21 John St., Newport, R.I. 02840)

Philco Model 660 receiver; tunes 160 kHz to 18 MHz on 4 bands; has 10 tubes. Schematic needed. (Anthony Luthers, 232 Hoyt St., Kearny, N.J. 07032)

Hallicrafters Model SX-25 receiver. Schematic, operating manual and source for power transformer needed. (Jerry Hein, 1612 Woodcliff SE, Grand Rapids, Mich. 49506)

Mobile Communications Model MFM-150 receiver; has 14 tubes. Schematic needed. (George Hardy, 941 Lanterman Ave., Youngstown, Ohio 44511)

Zenith Model 8G005 "Trans-Oceanic" receiver, circa 1940; tunes BC and s.w. on 6 bands; has 8 tubes. Schematic needed. (Ronald Howe, 3504 Joliet St., New Orleans, La. 70118) —30—

INFORMATION CENTRAL

(*Continued from page 78*)

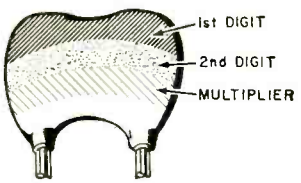
Considering all the ham lingo you use, I suspect you're planning to ham on the CB channels. Why wait till you're 18? You can get an amateur radio license at any age—some fellows have passed the exam who were only seven years old at the time. In answer to your specific question, I don't know of any linear amplifier that would work, and I doubt that anyone is going to offer such an amplifier for sale now that the FCC is cracking down on CB'ers.

TV Channels. *Are the television channel numbers and frequencies the same around the world?*

They sure aren't! In the United States, we call 66-72 MHz Channel 4, but in Australia Channel 4 is 94-101 MHz, while across the Tasman Sea in New Zealand Channel 4 is 174-181 MHz. The Soviets call 84-92 MHz Channel 4. France and Monaco spot Channel 4 between 54-66 MHz, although most of Continental Europe calls 62-68 MHz Channel 4. As you can see, it's very confusing.

Colorful Capacitors. *I just purchased some new electronic equipment that contains strange-looking capacitors. There are very wide, brightly colored bands (three of them) running lengthwise around the body of each capacitor. How do I read the values of these units?*

The capacitors you see in your new gear are top-quality Mylar or polyester film capacitors. Generally speaking, they are used in printed circuit equipment and are not usually available from radio parts jobbers and distributors. The capacitors are "read" by noting the color of the band farthest away from the leads. This band denotes the first digit. The middle band is



the second digit, and the colored band closest to the leads is the multiplier. The usual color-coding of black, meaning 0, through to white, meaning figure 9, applies to these capacitors. The value is always read in picofarads and the multipliers are: black, 1; brown, 10; red, 100; orange, 1000; yellow, 10,000; and green, 100,000. -30-

SOLID STATE

(*Continued from page* 85)

diameter music wire and 0.007-inch diameter nickel wire.

First, bend the music wire to form a spring with small end loops. Then, form the nickel wire into a single loop and attach its outer ends to the spring loops by twisting and soldering. The spring is compressed during this operation so that the nickel wire is held under tension.

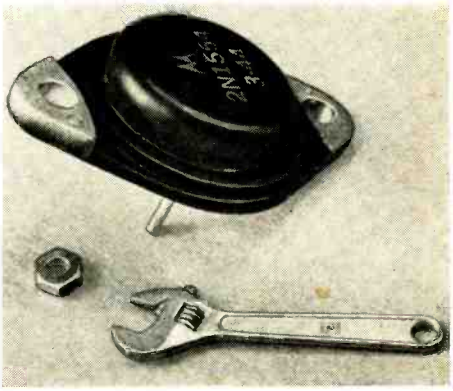
Squeeze the spring, expanding the nickel wire loop, and slip the loop over the transistor leads until it touches the case. Then release the spring, tightening the nickel wire loop and shorting the transistor leads together. You can now remove the manufacturer's protection feature (slip off the eyelet, untwist the leads, etc.). Finally, an insulated Transpad is slipped over the transistor's leads and pushed up against the taut wire loop to serve as a retaining disc.

The protected transistor can now be inserted in its socket and mounted on a circuit board, or soldered in position. Once the transistor is installed, the protective device can be removed either by compressing the spring (opening the nickel wire loop) or clipping the fine nickel wire. And another thing: use a soldering iron—not a gun—when wiring MOSFET's, and be sure to ground the tip of the iron to the substrate lead before soldering the gate lead in place.

Until next month . . .

Lou

WITHDRAWN FROM MARKET



Due to production and patent problems, the Lou Garner Enterprises on April 2 regretfully announced the withdrawal of the super-power transistor. Interest in this new development was confined to April Fool's Day.

QUIZ ANSWERS

(Quiz appears on page 63)

1 — B The slope of these curves represents the ratio I_P/E_P, or conductance (the reciprocal of resistance). As the plate voltage is increased, the slope and conductance also increase, and the resistance decreases.

2 — A The fundamental and low-frequency components of a square wave contribute chiefly to the center portion of its flat top. Thus, if an amplifier under test attenuates the low frequencies, a dip appears in the center of the square-wave test signal.

3 — B The slope of this curve represents the ratio I_C/I_B, or beta, the current gain of a transistor. As the base current increases, the slope of the curve and beta decrease.

4 — A Overmodulation can reduce an r.f. carrier to zero amplitude during a period of time as shown by the thin base line through the modulation envelope.

5 — A The slope of this family of curves indicates changes in the conductance of the transistor. As the collector voltage (V_{CE}) is increased, the slope and conductance decrease, and the resistance increases.

6 — B The slope of this curve represents the ratio I_P/E_G, or mutual conductance (Gm) of this vacuum tube. As the grid voltage (Eg) is increased, the slope and Gm decrease.

7 — B The slope of a load line represents the conductance of the load resistance. The load line with the lesser slope (B) shows a lower conductance, or higher resistance.

8 — B The slope of this curve reflects the ratio B/H, the permeability of the core material. As the curve goes over the knee, the slope and permeability both decrease.

9 — B At its peak amplitude, a sine wave changes from one finite value to another, but as it passes through zero it changes from a finite value to zero, resulting in an infinite percent change.

10 — A When the windings of a tuned air-core transformer are overcoupled, a dip is produced in the center of an otherwise single-peaked frequency-response curve, and two new resonant peaks occur at slightly higher and lower frequencies.

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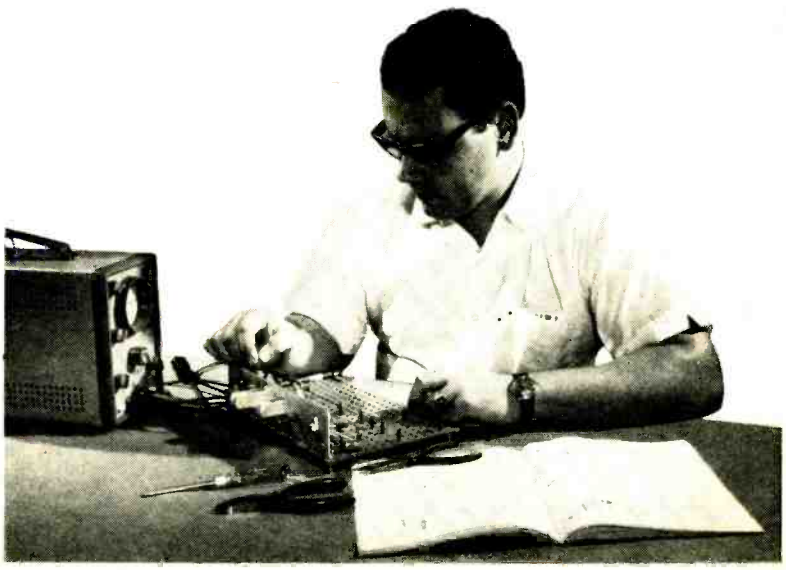

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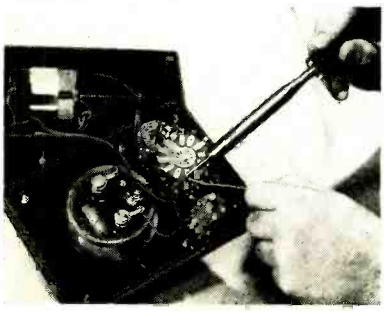
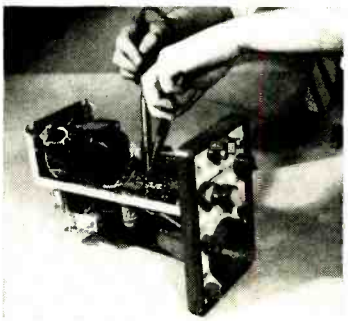
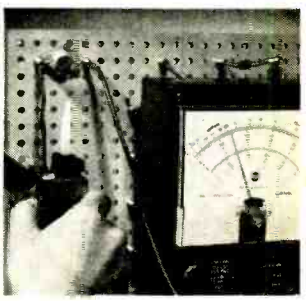




Construction of Oscilloscope.

Temperature experiment with transistors.



ON THE CITIZENS BAND

(*Continued from page* 82)

tant to accept the challenge, we did, out of curiosity, round the corner to find out what it was all about. We ran smack dab against the world's tallest man! Henry Hite is 8'2" tall and weighs 300 pounds. He wears a size 19 shirt with a 42" sleeve length, and his shoes step out at size 22!

In his travels for the Wilson Certified Meat Co., Henry covers many miles. We asked him about transportation problems because of his height. "Two Volkswagens," he replied, "one for each foot." We inquired about sleeping problems en route. Henry advised that motels usually put two beds

Photo by Greg Cook

The world's tallest man, Henry Hite, makes your CB Editor, who is a mere 5'8", look like a midget.

together for him, topping it off with, "that's a lot of bunk." Henry told us that his five brothers and seven sisters all stood under 5'11". "My father was an electrician," he went on, "and I was his first shock!"

So, we bypassed the "long-range" walkie-talkie bet, especially since we had it figured that the height difference between us just may have given Henry an extra 2½ to 6 miles communicating range.

Stalled in the Snow. CB radio fought back at heavily drifting snow near Camden, Ohio, recently. The Camden school bus, with 36 children in it, had stalled in the snow, and the battery was dead. Nearby, the car of Miss Andrea Nielsen, an English teacher, equipped with mobile CB radio, was stuck in 6-foot snow drifts.

At 9 p.m., after five hours of trying to raise help on her CB unit, Miss Nielsen received an answer from Mrs. Sandy Suman, Eaton, Ohio. However, efforts of the two to get help seemed hopeless until their conversation was intercepted by Harold Glaze, KPM5143, of Norwood, Ohio. Glaze made several local calls for help and notified the Ohio State Highway Patrol. He then stayed with his CB rig to keep in touch with the marooned group until help had arrived.

The eight-hour ordeal ended a little after midnight, when the Preble County Highway Department arrived with a bulldozer and several trucks. The children were quickly returned to Camden High School where an emergency crew of mothers had prepared cocoa, coffee, and hot food.

I'll CB'ing you.

—Matt, KHC2060

SHORT-WAVE LISTENING

(*Continued from page* 87)

by the International Telecommunications Union. However, members of the ANARC and many other SWL DX'ers feel that the running markers qualify as "open broadcasts and should be acceptable transmissions for verification cards or letters.

The ANARC also reports considerable success on the part of its Frequency Recommendations Committee. This Committee has been working with a number of short-wave stations (in Portugal, the Vatican, Netherlands, Japan, Switzerland, etc.) in an effort to help these well-known broadcasters select the most desirable frequencies for top-rated reception in North America.

New SWL Books Available. In addition to the *World Radio TV Handbook* (1967 Edi-

tion), a new Edition of *How To Listen To the World* (HTL) by O. Lund Johansen is now available which contains several dozen superb articles on the various aspects of SWL'ing. The price of the 1967 HTL Edition is $3.50.

The invaluable WRTH is again 304 pages in length, but contains considerably more information than was published in the 1966 Edition. The price is still $4.95 postpaid. Both of these books can be obtained from Gilfer Associates, P. O. Box 239, Park Ridge, N.J. 07656.

CURRENT STATION REPORTS

The following is a resume of current reports. At time of compilation all reports are as accurate as possible, but stations may change frequency and/or schedule with little or no advance notice. All times shown are Greenwich Mean Time (GMT) and the 24-hour system is used. Reports should be sent to SHORT-WAVE LISTENING, P.O. Box 333, Cherry Hill, N.J., 08034, in time to reach your Short-Wave Editor by the fifth of each month; be sure to include your WPE identification, and the make and model number of your receiver. We regret that we are unable to use all the reports received each month, due to space limitations, but we are grateful to everyone who contributes to this column.

Angola—A new Portuguese-speaking station on 7300 kHz is believed to be one of the *R. Commercial do Angola* stations; s/on is at 0600 with trumpets and drums, the anthem "A Portuguesa," then pop music and commercials; news is given at 0630 and 0700.

Bermuda—DX'ers needing this country should try for ZFBI, Hamilton, a 24-hour medium-wave station operating on 960 kHz.

Brazil—*R. Sirena,* Leopoldina, has been tuned on 2410 kHz from 0035 in Portuguese with Latin American pop tunes. Seldom logged *R. Alvorada,* Londrina, was heard on 3345 kHz from 0000 with ID and light music. Try for these low frequency stations around dusk; they fade in the early evening hours. Station ZYU61, *R. Guaiba,* Porto Alegre, is usually heard well around 2200 on 11.785 kHz. According to a verification letter, *R. Cairari,* Porto Velho, Rondonia, operates on 4955 kHz, 250 watts, from 1000 to 0330; reports go to Pe. Vitor Hugo at C. P. 104, Porto Velho.

British Honduras—*R. Belize* is scheduled at 1200-0400 on 834 kHz (20 kW) and 3300 kHz (5 kW), according to their latest QSL. Many monitors have reported that reception on both channels is equally good.

Cameroon—*R. Yaounde.* 4972 kHz, has been observed with an Eng. xmsn at 0530-0600.

Canary Islands—*R. Nacional Espana,* Tenerife, is on a new frequency of 15,380 kHz; it was logged at 2000 s/on in Portuguese and from before 0325 to 0400 s/off with music and Spanish.

Cape Verde Islands—Station CR4AC, *R. Barlavento,* has been heard on 3910 kHz with a fair-to-good signal from 2330 to 0000 s/off. They sign off with a gong and "A Portuguesa." Reports go to C. P. 29, San Vicente.

Costa Rica—*R. Reloj,* 6210 kHz, San Jose, is heard

SHORT-WAVE ABBREVIATIONS

anmt—Announcement	N.A.—North America
Eng.—English	QSL—Verification
ID—Identification	R.—Radio
IS—Interval signal	s/off—Sign-off
kHz—Kilohertz	s/on—Sign-on
kW—Kilowatts	xmsn—Transmission

well at 0100-0130, 0330-0400, and 0500-0530 in Spanish with American pop music; a program at 0400 and 0600 entitled "CR en el corazon de los Ticos," with greetings to relatives, is intended for reception in Western U. S. (on Sundays only). Station TIQ, *R. Casino,* Puerto Limon, is heard well some nights from 0430 to 0540 on 5954 kHz with a program consisting of U. S. and Caribbean pop music, anmts in Eng., and many soft drink commercials; the broadcast is called the "Atlantic Coast broadcast" and is apparently beamed to Americans living in the Canal Zone.

Ecuador—Station HCAU2, *R. Atalaya,* Guayaquil, is still using its old 4601-kHz channel rather than the listed one, 4790 kHz; it is noted regularly around 0100, with an extended schedule on weekends. Another station which does not use its listed frequency of 4765 kHz is HCAK2, *Radiodiffusion del Ecuador,* Guayaquil, which was noted at 0210 with a sports review on 4652 kHz. Station HCJB, Quito, now uses 15,235 kHz for its 1800-1855 broadcast to Scandinavia in French, dual to 17,890 kHz. A new station is *R. Jesus del Gran Poder,* Iglesia de San Francisco, Quito, audible from about 0030 to s/off at 0210-0240 with mostly religious programs on 5070 kHz; do not confuse this one with *R. Sutatenza,* Bogota, Colombia, on 5075 kHz, or *R. Catolica,* Quito, on 5062 kHz, both of which are on the air at the same time.

Ethiopia—Station ETLF, *R. Voice of the Gospel,* Addis Ababa, has been logged on three new channels: 7292 kHz, around 0430 with exotic music; 15,120 kHz, with fair signal at 1900-1945; and 15,315 kHz, with a news summary in Eng. at 1359.

Germany (East)—The current schedule for *R. Berlin International* to N. A. is 0100-0130 and 0230-0300 on 9675 and 9730 kHz (East Coast), and 0345-0415 and 0445-0515 on 9650 and 11,700 kHz (West Coast).

Gilbert & Ellice Islands—*R. Tarawa,* VTW2, is now scheduled on 4912.5 kHz in Eng. from Sunday to Thursday at 1845-2000 and in local dialects on Mondays, Wednesdays, and Fridays at 0430-0600 and on Sundays at 0430-0630. The power is 2000 watts with primary coverage intended only for the islands.

Greenland—*Gronlands Radio,* Godthab, has been heard in Texas on 5980 kHz at 2200-2235 in (probably) Greenlandic, at 2235-2240 with IS composed of six notes on a celeste, then a religious program until fade-out around 2330.

Guatemala—Station TGBA, *R. Maya de Barillas,* Santa Cruz de Barillas, 2360 kHz, was noted at 0505 with "march" music; they s/off with the "Lord's Prayer" at 0520. Station TGSH, *R. Sorti,* Solola, 3380 kHz, is readable from 0100 to 0200 s/off with letters from listeners and music on weekdays, and marimba music on Sundays; at s/off time, the theme from "Bonanza" is played.

Haiti—Station 4VB, *La Voix de la Revolution Duvalieriste,* Port-au-Prince, is strong on 5905 kHz from 2350 to 0405 in French with band, classical and pop music, and time checks. Station 4VEB, *R. Caraibes,* Port-au-Prince, has been noted off-frequency recently; it was tuned on 6007 kHz at 0338 in French with poor modulation. Station 4VM, *Radiodiffusion Haitienne,* Port-au-Prince, 4940 kHz, is good at times when the Dominican Republic station on the same channel is off the air; it can be heard after 0100 but fades before 0200, features music periods, and uses only 360 watts.

John Melville is a newsreader and announcer in the External Services of the BBC, in London, England.

Italy—The three national programs from Rome are scheduled as follows: first program at 0530-1300 and 1400-2230 (Sundays and holidays at 0530-2230) on 6060 and 9515 kHz; second program at 0530-1120 and 1200-2145 (Sundays and holidays at 0530-1130, 1200-1300, and 1330-2145) on 7175 kHz; third program daily at 1730-2330 on 3995 kHz. "Nocturne," eight hours of music and short news bulletins, is aired daily at 2145-0525 from Rome on

845 kHz, Milan I on 899 kHz, and Caltanisetta (Sicily) on 6060 and 9515 kHz. The 845-kHz channel is often heard in N. A.

Kenya—*Voice of Kenya,* Nairobi, 4885 kHz, was noted with a fair-to-good signal from 1930 to 2005 s/off in Eng.; there was a newscast during the last five minutes.

Korea (North)—*R. Pyongyang* is audible at times on 6295 kHz in an Asiatic language with Far East music; the signal peaks around 2330 and there is considerable polar flutter and some frequency drift.

Kuwait—*R. Kuwait,* 4967.5 kHz, is good at 2038 with Arabic singing and/or chanting. News in Arabic is given after 12 chimes at 2100 and s/off occurs seven minutes later.

Malgache—*R. Universite* in Tananarive is on the air at 0315-0430 and from 1530 to approximately 1905 on 3370 kHz (Sundays at 1200-1400 on 6070 and 7880 kHz, at 1700-1915 on 3370 kHz). Programs consist mainly of university lectures and classical music.

Martinique—Fort-de-France. 5995 kHz, has pop records from 2230 to an abrupt closing at 2300 (Saturdays to 0000. closing with a complete ID and anthem).

Mexico—Station XEJG, the Jalisco state station in Guadalajara. is good to excellent on the West Coast (despite its low power around 0400) with classical music and infrequent anmts. On 4820 kHz, it blocks HRVC (Honduras) most of the time.

Nigeria—The External Service from Lagos to N.A. is heard at 2058-2203 on 9690 kHz with news and music. Look for the National Service on 4990 kHz from 2115 to 2145 with a religious program; this service is aired at 1600-2230 (Satudays to 2300). The Commercial Service from Ibadan has Eng. and vernaculars from 0545 on 6050 kHz; news at 0600.

South Africa—*R. RSA,* Johannesburg. is still moving; at press time it is back on 11.900 kHz to N.A. at 0000-0400. Other xmsns noted: on 7210 kHz at 2100 in Eng.: on 9570 kHz at 0510 to Transvaal and Zululand; on 15.215 kHz at 2240 in Eng. to Europe and on 15.285 kHz at 2155/close.

Sudan—*R. Omdurman* broadcasts Arabic at 0400-0800. 1200-1300. and 1400-2100 (Fridays at 0400-0900) on 9508 and 4944 kHz. using two 20-kW transmitters. They also list a daily program to Europe on the same frequencies (no language specified) at 1340-1400.

DX PROVINCES AWARDS PRESENTED

To be eligible for one of the DX Provinces Awards designed for WPE Monitor Certificate holders, you must have verified stations (any frequency or service) in 6, 8, 10, or 12 Canadian provinces. (For these awards, the Yukon Territory and the Northwest Territories are considered as provinces.) The following DX'ers have qualified for and received awards in the categories indicated.

TWELVE PROVINCES VERIFIED

Ed Fellows (WPE7BLN), Seattle, Wash.
Charles McGeorge (WPE6FTX), Fontana, Calif.
Robert Ramlow (WPE9FTQ), West Allis, Wis.
James Young (WPE6ENA), Wrightwood, Calif.

TEN PROVINCES VERIFIED

Reg Firth (WPE2GFO), Amsterdam, N. Y.
Joe Stauhs (WPE2SW), Belleville, N. J.
Mike Tilbrook (WPE3FTZ), Pittsburgh, Pa.
Cliff Cardwell (WPE5LU), Dallas, Texas
Robert Crowell (WPE4HKO), Fort Walton Beach, Fla.
Lavoyd Kuney (WPE8AD), Detroit, Mich.
Phil Berkeley (WPE1ENY), Swampscott, Mass.

EIGHT PROVINCES VERIFIED

David Kaplan (WPE1FIJ), Hartford, Conn.
Billy Williams, Jr. (WPE4EAX), Jacksonville, Fla.
Robert French (WPE8FGH), Bellaire, Ohio
Gary Ligon (WPE4JAX), Spindale, N. C.
Richard Hansen (WPE6FJO), Santa Clara, Calif.
Barry Weisman (WPE1GRQ), Newton, Mass.
Ron Hopkins (VE7PE7P), Trail, British Columbia, Canada
R. H. Lauzon (WPE2MWS), Pittsford, N. Y.
Stanley Head, Jr. (WPE8YC), Whitehall, Ohio

SIX PROVINCES VERIFIED

Kenneth Snyder (WPE3GUD), Penn Run, Pa.
Samuel Gold (WPE6DXA), San Francisco, Calif.
Eugene Bond, Jr. (WPE2JHW), Moorestown, N. J.
Leo May (WPE7CEU), Corvallis, Oreg.
Steve Passner (WPE2NSC), Glen Ridge, N. J.
John Osborne (VE3PE2HA), Toronto, Ontario, Canada
W. E. Raczko (WPE8JBT), Toledo, Ohio
Marion Lilienthal (VE3PE2DO) Waterloo, Ontario, Canada
Carl Durnavich (WPE9IFO), Riverdale, Ill.
Richard Pistek (WPE9HOA), Chicago, Ill.
James Peshock (WPE5DQD), Richardson, Texas
Charles Laddish (VE7PE1BA), Vancouver, British Columbia, Canada
John Cate (WPE1GGO), Dover, N. H.
William Campbell (WPE2JHA), Canandaigua, N. Y.
Vincent De Meis (WPE3FEE), Philadelphia, Pa.
Ronald Dohmen (WPEØEGH), New Prague, Minn.
Ray Drozs (WPE9EYU), Chicago, Ill.
Suraphorn Eamegdool (WPE2MTA), Passaic, N. J.
Geoff Fleck (WPE2OQB), Mt. Kisco, N. Y.
Angel Garcia (WPE2LXA), New York, N. Y.
Donald Hughes (WPE6GBB), San Francisco, Calif.
James Meinken (WPE9HDM), Skokie, Ill.
Alden Phaneuf (WPE2JPX), Champlain, N. Y.
Ronald Sibbitt (VE3PE2HB), Cooksville, Ontario, Canada
John Thompson (WPE9HMW), Wilmette, Ill.
Foster Cooperstein (WPE1GCF), New Bedford, Mass.
David Brown (WPE6ENI), Woodland Hills, Calif.
Barry Campbell (VE3PE2IV), Belleville, Ontario, Canada
Paul Emch (WPE6GBG), Trabuco Canyon, Calif.
Percy Kesteven (VE6PE7F), Edmonton, Alberta, Canada
Ron Miller (WPE9HCG), Peoria, Ill.
Walter Miscichowski (WPE2BEH), Buffalo, N. Y.
Roy Moore (WPE4FWH), Hazard, Ky.
James Pogue (WPE9HLJ), Farmland, Ind.
Richard Spritz (WPE3GGE), Elkins Park, Pa.
Richard Sears (WPE1FNM), Cambridge, Mass.
Henry O'Meara (WPE2OCG), Brockport, N. Y.
Arman Dolikian (WPE8IIO), Detroit, Mich.
John Sheatsley (WPE8JDC), Toledo, Ohio
Tom Taggart (WPE8IHL), Lakewood, Ohio
Arno Feltner (WPE5CN), New Braunfels, Texas
Gerry Cohen (WPE1FNT), West Hartford, Conn.
Phil Raczka (WPE8IRL), Cleveland, Ohio
David Lalor (WPE5EIQ), Corpus Christi, Texas
Mike Thompson (VE7PE1BE), Vancouver, British Columbia, Canada
Leo Stowell (WPE9HTU), East Chicago, Ind.

SHORT-WAVE CONTRIBUTORS

Stan Mayo *(WPE1GMF)*, Portland, Maine
Ron Boisvert *(WPE1GTB)*, Manchester, N. H.
William Graham *(WPE2LMU)*, Binghamton, N. Y.
Kenneth Coyne *(WPE2LSI)*, Long Beach, N. Y.
Robert Kaplan *(WPE2MJR)*, Bronx, N. Y.
Bernard Greene *(WPE2MNJ)*, Brooklyn, N. Y.
Richard Kline *(WPE2MUY)*, Englewood, N. J.
Thomas Reilly *(WPE2OMG)*, Binghamton, N. Y.
Pete Macinta *(WPE2ORB)*, Kearny, N. J.
Rick Charnes *(WPE2PBV)*, Cherry Hill, N. J.
Bob Eckel *(WPE2PHE)*, Metuchen, N. J.
Wayne Blair *(WPE3FAZ)*, Altoona, Pa.
Michael King *(WPE3GPI)*, Rockville, Md.
Bob Huber *(WPE3GUN)*, Wilmington, Del.
Robert Wilkner *(WPE4ACP)*, Pompano Beach, Fla.
John Cobb *(WPE4AJ)*, Cartersville, Ga.
Grady Ferguson *(WPE4BC)*, Charlotte, N. C.
Dan Henderson *(WPE4GIW)*, Laurel, Md.
John Ethridge *(WPE4IHC)*, Martin, Tenn.
David Meisel *(WPE4IRS)*, Charlottesville, Va.
James Smith *(WPE4IZJ)*, Cynthiana, Ky.
David Tinis *(WPE4JAR)*, Miami, Fla.
James Helmke *(WPE5DCV)*, San Antonio, Texas
Stewart Mac Kenzie *(WPE6AA)*, Huntington Beach, Calif.
Lawrence Confer *(WPE6BLX)*, Warner Robins, Ga.
Trev Clegg *(WPE6FAF)*, Fresno, Calif.
Harold Chavis *(WPE6GOL)*, Monterey, Calif.
Juris Burkevics *(WPE7CLJ)*, Fircrest, Wash.
Jim Pruitt *(WPE7FFK)*, Orofino, Idaho
Robert French *(WPE8FGH)*, Bellaire, Ohio
Richard Riedel *(WPE9GTQ)*, South Bend, Ind.
Bill Vogt *(WPE9IND)*, Tinley Park, Ill.
A. R. Niblack *(WPE9KM)*, Vincennes, Ind.
Allen Windhorn *(WPEØEPJ)*, St. Peter, Minn.
Jack Perolo *(PY2PE1C)*, Milwaukee, Wis.
Ron Duncan *(VE3PE2GX)*, Willowdale, Ont., Canada
Edward Kusalik *(VE3PE2KF)*, Northwood, Ont., Canada
David Alpert, Morton Grove, Ill.
Jonathan Dandridge, Dorchester, Mass.
Glenn Hauser, Albuquerque, N. M.
Robert Hill, Riverdale, Md.
Scott Meador, Waco, Texas
James Peavey, APO, San Francisco, Calif. (Korea)
James Riviello, Cherry Hill, N. J.
William Tucker, Mission, Kans.
R. H. Vander Kraats, Islington, Ont., Canada
Sweden Calling DX'ers, Stockholm, Sweden

Tanzania—Dar-es-Salaam is now operating on 5055 kHz, where it is heard at 0315-0330 in Arabic.

Tunisia—*Idaat al jumhuriyah al Tunisiyah*, Tunis, 6072.5 kHz, was heard to 2330 s/off, all-Arabic. This one drifts in frequency and may run as high as 6083 kHz.

Turkey—The latest schedule from Ankara reads: 9515 kHz in Turkish at 1530-1815 and 1945-2145; 9745 kHz in Arabic at 1600-1630 and 1830-1930, Rumanian at 1630-1700, Bulgarian at 1700-1730, Serbo-Croate at 1730-1800, and Greek at 1800-1830; 15,160 kHz in Turkish daily at 0420-1300 (on Saturdays to 1200, on Sundays to 1100), in German at 1830-1900, French at 1900-1930, Eng. at 2200-2230; 17,820 kHz in Persian at 1345-1415 and 1530-1600, in Eng. (to S. and S. E. Asia) at 1415-1445 and in Urdu at 1445-1515.

Uganda—Difficult to pick up except when band conditions are just right. Kampala, 4976 kHz, has

DX AWARDS PROGRAM RULES

Here's an easy way to get a copy of the rules and regulations for each of the three phases of the DX Awards Program to date (Countries, States, and Provinces). Just supply a postage stamp or return envelope, and your Short-Wave Editor will send you a leaflet containing the rules for all three phases—plus a copy of the official Countries List for DX Awards. The stamp or envelope, with your request, should go to: DX AWARD RULES, P. O. Box 333, Cherry Hill, N. J. 08034.

MEDIUM WAVES

Here is a listing by frequency (in kilohertz) of some of the numerous stations currently being heard from Central and South America and the Caribbean area. The column of figures at the right represents the transmitter power (in kilowatts).

540	HJKA	Bogota, Colombia	0700-1000	10
600	HJHJ	Barranquilla, Colombia	0700-0800	25
650	YVQO	Maracaibo, Venezuela	0700-0900	10
655	YSS	San Salvador, E. S.	0100-0200	10
670	YVLL	Maracaibo, Venezuela	0700-0900	10
	HRN	Tegucigalpa, Honduras	0900-1000	10
675	YND	Managua, Nicaragua	0300-0400	15
750		Point Galena, Jamaica	0450-0500	5
780	YVOD	San Cristobal, Venezuela	0800-1000	10
		R. Barbadoes	0930-1000	10
820	HJED	Cali, Colombia	0800-1000	50
840		Unidentified Brazilian	0500-0600	
	THKL	Guatemala City, Guatemala	0500-0600	5
	HJBI	Santa Maria, Colombia	0600-0700	10
850	YVMV	Managua, Nicaragua	0700-1000	10
870		R. Crystal Guayaquil, Ecuador	0700-0800	5
880	THJ	Guatemala City, Guatemala	0600-0700	10
890	HJCE	Bogota, Colombia	0600-1100	10
	HIPJ	Santa Domingo, D. R.	0800-0900	1
900	TICS	San Jose, Costa Rica	0500-0600	6
1120	YVMF	Maracaibo, Venezuela	1800-2000	10
1165		R. Americas, Swan Island	all night	50

been logged at 2055 with native music, at 2100-2105 with Eng. news, and to 2200 (Saturday) with soft African music. (One of our veteran monitors has been trying for years to log this station, and your Short-Wave Editor has not been lucky enough to do so as yet either.)

Windward Islands—Windward Islands Broadcasting Service, St. Georges, is now on 11,920 kHz, where it is heard at times from 2040 to 0215/close, and again around 0335 with recordings, request numbers, and news of the islands. The 5010-kHz channel to Caribbean areas can be heard from 2200 to 2245 s/off.

Clandestine—*R. Euzkadi* has been heard in Basque and Spanish to 2312 s/off on 11,280 kHz (varying to 11,248 kHz) and on 13,301 kHz (varying to 13,280 kHz). —30—

AMATEUR RADIO

(*Continued from page 80*)

NEWS AND VIEWS

Dan F. Littel, WA9RTU, 5201 W. Fairmount Ave., Milwaukee. Wis., celebrated getting his General ticket by telling us about his successes as a Novice. Using a home-brew, 30-watt transmitter feeding a 40-meter dipole antenna and a Heathkit HR-10 receiver, Dan knocked off 31 states, Ontario, and Puerto Rico. Now, with the new license and a Heathkit "Cheyenne" transmitter, he offers to schedule anyone needing a Wisconsin contact—QSL card guaranteed . . . While we are in Wisconsin, **Jim Jindrick, WA9QYC,** trustee for the William Horlick High School Radio Club, would like to hear from W8's, 9's, and Ø's interested in organizing a high school-teen age net. His address is: 801 Florence Ave., Racine, Wis. 53402 . . . **Ron White, WN4CGT,** 4868 Aster Drive, Nashville, Tenn., works 80 and 40 meters, although he apparently prefers 80 much of the time. Ron has three antennas—two 40-meter dipoles and an 80-meter dipole, two transmitters—a Heathkit DX-100 and a home-brew 10-watter, and a Hallicrafters SX-96 receiver. After three months, he has had 126 con-

tacts in 21 states and Canada, with 52 of them confirmed.

Anthony J. Czaja, WA9RYB, 313 East 119th St., Chicago, Ill., also celebrated the arrival of his big "hunting" license by submitting his "News and Views," not that he did so bad with his Novice license. His Heathkit DX-40 transmitter, teamed up with an end-fed wire and a Hammarlund HQ-110 receiver, eked out a Hawaiian contact on 40 meters and quite a few states on 80, 40, and 15 meters; but he really started to go places after he built a 2-element, 15-meter beam. Forty countries in all continents and 46 states in eight months is the latest WN9RYB record . . . **Joseph Rock, WN3GLP,** Box 162, Knoxville, Md., works the three lower Novice bands. He feeds a 15'-high, 40-meter dipole from a Knight-Kit T-50 transmitter, and he receives on a Hallicrafters SX-99. With this gear, it took Joe seven weeks to work 31 states and four countries, including Australia. Contact WN3GLP if you need a Maryland QSL card or want to qualify for a Rag-Chewers' Certificate . . . **Greg Vatt, WAØNOS,** 1527 30th Ave., Greeley, Colo., started his Novice career with a Heathkit "Apache" transmitter throttled down to 75 watts. A Hammarlund HQ-110-AC-VHF receiver, and a Hy-Gain 14-AVQ vertical antenna completed the station. Now, however, a Swan 350 transceiver talks up to 400 watts to drive a Hy-Gain 18-AVQ vertical antenna on all amateur bands from 80 through 10 meters. Five more states will complete Greg's Worked All States effort.

Mike Forsyth, WB6SAJ, 789 Colusa Ave., El Cerrito, Calif., likes to work on the bands where antennas are short. Using a Knight-Kit T-60 transmitter to excite a 4-element beam, he has worked 16 states, Venezuela, and the Bahama Islands on 6 meters. He receives on a Heathkit "Mohican," AMECO 6-meter converter combination. And although Mike didn't say what he used up there, he is looking for 420-MHz skeds . . . **Gary Tremblay,** 4566 Deal Drive, Long Beach, Calif., was **WN6NYM** when he wrote but is probably signing WB6NYM now, as he was waiting for his Technician test to arrive. Gary started on 80- and 40-meter CW, but he didn't care much for the interference; so he migrated to 2 meters and the wide-open spaces. He uses either an AMECO TX-62 or a Heathkit "Twoer" to excite a 2-meter ground-plane antenna. He receives on a Gonset GR-212 receiver in combination with a home-built converter.

Edward A. Prazmo, WA8SML, 20019 Anglin, Detroit, Mich., reports that the interference in the Novice band drove him to get his General Class license as quickly as he could. But during the "trip," his Hallicrafters S-120 receiver and Heathkit DX-60 transmitter worked 32 states and six countries. Now, as a General, his total is 45 states and 25 countries. Ed rates 4U1ITU at the International Telecommunications Union headquarters, Geneva, Switzerland, as his best DX. A 40' vertical and an inverted V handle the outside work at WA8SML . . . Starting with a roar, **Herman Cone, III, WN4DBB,** 1811 Dalton Rd., Greensboro, N.C., worked 19 states in 13 days. Now he has 40 states and 12 countries worked. A Heathkit DX-60A transmitter driving a Hy-Gain 18-HT vertical antenna and a Heathkit SB-300 receiver do the work on the lower frequencies, and a Heathkit "Twoer" and a home-built, indoor halo antenna serve for 2-meter local work. Also on the operating desk are a Hallicrafters "Sky Buddy" receiver and a Heathkit HD-10 electronic keyer.

Remember that the first step towards having your "News and Views" or photo appear on these pages is for you to write that letter and send that picture you have been planning to send for so long. Please keep your club bulletins coming, and let us know as far in advance as possible about any new amateur code or theory classes. The address is: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P. O. Box 678, Gary, Indiana 46401.

73, *Herb, W9EGQ*

BIOLOGICAL RADIO—ESP

(*Continued from page 58*)

outside world are only the very beginning of such communication. As an example of the possibilities, Puharich described techniques developed in his laboratories that permit the totally deaf to hear some sounds. Beaming super-high-frequency radio signals in the 2-gigahertz range, Intelectron scientists made all 32 subjects in their test hear what amounts to a radar beam. Deaf persons heard not only tones and music, but speech as well, although it was physically impossible for them to receive normal sounds (all had total loss of hearing—the cochleas had been totally destroyed).

Puharich also claimed that the sensation of color had been communicated to subjects purely by radio frequency signals! Experiments in mental telepathy have also been conducted by Intelectron with positive results, even though the subjects were placed in chambers screened from radio frequency signals. Communication over distances of 200 miles has been reported.

Fact or Fantasy? Military interest in mental telepathy is understandable. Thought control could be a powerful offensive weapon—far simpler than forcing an enemy to surrender under an aerial bombing or other physical attacks. If the secret of the relationship between ESP and radio signals can be uncovered, powerful transmitters tuned to the "built-in receivers" of the human brain could bombard victims with orders to surrender.

Although few people are talking about it, the world's two greatest powers are diligently investigating the scientific basis for mental telepathy. Many scientists are lukewarm to the idea of ESP, or the Russian "Biological Radio," and some privately discredit it, but other scientists subscribe to theories that read like science fiction. Scientists in the United States laboratories, either too embarrassed to admit that they are researching the mind-reading bit, or cagier than the Russians, have less to say. But, to reuse the old cliché, where there's smoke, there must be fire. —30—

ELECTRONICS MARKET PLACE

COMMERCIAL RATE: For firms or individuals offering commercial products or services. $1.00 per word (including name and address). Minimum order $10.00. Payment must accompany copy except when ads are placed by accredited advertising agencies. Frequency discount: 5% for 6 months; 10% for 12 months paid in advance.

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GENERAL INFORMATION: First word in all ads set in bold caps at no extra charge. Additional words may be set in bold caps at 10¢ extra per word. All copy subject to publisher's approval. Closing Date: 1st of the 2nd preceding month (for example, March issue closes January 1st). Send order and remittance to: Hal Cymes, POPULAR ELECTRONICS, One Park Avenue, New York, New York 10016.

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